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Western Australia.

JOURNAL

OF THE

DEPARTMENT OF AGRICULTURE

OF

WESTERN AUSTRALIA.

By Direction of

The HON. THE MINISTER FOR AGRICULTURE.

PUBLISHED QUARTERLY.

DECEMBER, 1924.

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"THE JOURNAL OF AGRICULTURE."

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THE EXPERIMENT FARM AND AGRICULTURAL PROGRESS.

It is proverbial that in the make-up of the farming community the conservative element holds no small place. The farmer, above all men, is a believer in the wisdom of his ancestors, and he is apt also to think that his inheritance of farming wisdom covers everything that it is possible to know on the subject. But of recent decades all over the world a new spirit has been moving fruitfully in the farming soul. The Man on the Land now admits that much as his ancestors knew about the land and the best means of using it, their knowledge did not embrace everything pertaining to matters agricultural. The Experiment State Farms in Western Australia and in other States of the Commonwealth, and the model farms conducted under the Ministry for Agriculture in Britain, are concrete and tangible evidences of the existence of the new spirit, not only of its existence, but of its desire to learn and to profit by learning.

A handful of years ago when the Experiment Farms in this State came into existence, the idea was not received seriously by quite a number of the farmers of the time who were apt to regard it as mere scientific gilt upon the solid body of practical farming. For years the work done at the Experiment Farms attracted comparatively little attention, but to-day things are entirely different. The quality of the work done, and the hard and undeniable evidence furnished by results obtained, have shattered the iron bands of the old conservatism, and in Western Australia at least the farmers do not only accord the Experiment Farms their heartiest approval, but they take every opportunity of making themselves acquainted with the nature of the experimental work that is being carried on, and the lessons thus learned they are rapidly applying to their own interests. The farmer of a few years ago who, when he attended a Field Day at an Experiment Farm, was in the habit

of regarding the whole proceedings with a cynic humour, has disappeared, and he has been replaced by the farmer who spares no effort to get to the appointed place on the day arranged, well knowing that he will return home with his knowledge of farming matters very materially augmented. The cynic farmer, in short, has gone, and in his stead is the farmer's student, eager, alert and receptive. The new attitude of the farmer towards his own professional preoccupations is one of the happiest omens for the future welfare of the State. Stagnation we know is synonymous with decay, while progress spells material benefit all along the line. In every other avenue of industry, more particularly secondary industry, those engaged in it are always looking out for some means or other that will reduce cost of production or increase the amount and quality of the output, and their attitude in this respect is reasonable. The man who lags behind and does not keep himself well up to date must, and does, fall back in the race for patronage. Goods turned out by old-fashioned inefficient machinery cost more to produce and are not of the quality of those made by more modern appliances. In the matter of farming, the case is on similar lines. The farmer who does not prepare his land by the methods best adapted to the soil at his disposal, and who does not use the seeds and kind of fertiliser best suited to that particular class of soil, cannot be expected to achieve the same results as the man who has brought expert knowledge to bear upon the question and has conducted his operations along lines that have been proved to be the most effective and productive.

The Merredin Experiment Farm held its Field Day in the middle of October last. The numbers of people who attended, and the distances that many of them came from, and the keen interest that was displayed by all of them in everything they saw are sufficient of themselves to justify to the full the Government and the Department of Agriculture in the course that it has for years been pursuing, viz., that of affording educational information by a telling and indisputable object lesson. Merredin has already dispelled many old and cherished fallacies, and it has also enforced some little known and many new agricultural facts. The new comers from the Old Country—and several of such were present—had an opportunity of seeing some experimental work, the results of which probably shattered some preconceived but entirely erroneous beliefs. Quite a number of new settlers from Great Britain are under the impression that seeds that do remarkably well in England must for that reason also do equally well in Western Australia. But the assumption has no solid foundation, for it does not take account of the differences in climatic and soil conditions between the two countries. Not a few new settlers, their English training strong within them, have planted British seeds, and the result has been such as could not do otherwise than convince them that they had fallen into error. Among the many items at Merredin were rows planted with English seed and many new settlers who inspected these rows are very likely to profit by what they saw and to critically revise their preconceived notions as to the suitability of old-world seeds for the Wheat Belt

of Western Australia. The lesson of the wheat seed plots at the Experiment Farm is too obvious to be overlooked, but it is by no means a new lesson, although it is one that has, as yet, only been learned and taken to heart by a moderate percentage of the farmers of this State. Experimental work all over Australia has steadily been increasing the average wheat yield. In Victoria some of the results in this direction have been marvellous. In New South Wales and South Australia also the increase in yield has gone on steadily, and in Western Australia the experimental farm is driving home the same lesson. Much of the comment heard at Merredin at the last Field Day turned on this point. There are many farmers who are unable to increase their acreage, but the Experiment Farm has shown that the limitations imposed by acreage need not necessarily exist so far as yield is concerned. The farmer cannot add another acre to his holding, but by careful selection of seed, and by working his land in the manner that will call forth his highest productive powers, he can, under ordinary climatic conditions, increase his yield. In this matter of increased yield, the agricultural interest is following along the lines of development that have been traversed by the pastoral industry. The pastoralist of to-day is taking three or four more times the weight of wool per sheep from his flock than was done by his predecessor of an earlier generation. This result has been achieved by careful breeding, feeding and culling, and in the province of agriculture similar care devoted to the selection of the seeds and to the preparation of the field—the cradle of the crop—can give no other than results gratifying to the farmer. Already the work on the Experiment Farms in this State has solved a number of problems that have special interest to Western Australian farmers, and in so doing they are carrying out the Department's objective of always holding out the helping hand to the Man on the Land. In an article in this issue of the *Journal* dealing in detail with the operations at Merredin, there will be found a great deal that will be valuable and suggestive.

The Minister for Agriculture (Hon. M. F. Troy), in the course of his remarks on the occasion of the Merredin Field Day, after referring to the pesent position of agriculture in this State and the season's prospects, said that in farming, like everything else, the best results could only be obtained by following the best methods. In his view, fallowing and good crops were synonymous terms. It appeared to him that the farmer who cropped on cultivated land was doing something in the nature of courting disaster. It was significant that wherever fallowing was practised the average yield was steadily rising. Wimmera, in Victoria, was an instance in point. Farming on fallowed land was being conducted successfully at Southern Cross, and that fact alone spoke volumes in its favour. In his opinion it would be far better if settlers were to wait two years for a return off fallow than to take a risk on ploughed land. There was sound sense in the Minister's words, and the visitors at Merredin had an opportunity of verifying the fact through the object lesson provided on Field Day.

LUCERNE—THE QUEEN OF FODDER CROPS.

Geo. L. Sutton,
Director of Agriculture.

It is fitting that "Lucerne," because of its particular suitability for the nourishment of young stock of all kinds should be associated in the minds of farmers with maternal qualities, and in consequence called the "Queen" of fodder plants, just as Maize, with its sterner characteristics and greater suitability as a food for adult animals, is called the "King" of fodder plants. As food each is complementary to the other, and their alliance when brought about on the farm is followed by the happiest results.

Lucerne was introduced into Greece during the Persian Wars, about 490 B.C., so that it is known to have been cultivated for well over 2,000 years. It has therefore been well tested. It was taken to Spain by the Moors under the name of Alfalfa. The Spaniards introduced it to Mexico, and from that country it spread over South America and extended to the United States and Canada. In Canada and America Lucerne is known and cultivated as Alfalfa. This word is believed to be of Arabic origin, and derived from words which mean "the best fodder." It will thus be seen that its great value for fodder purposes has been long recognised, and the splendid reputation which this plant so early earned, and which by its name has come to us down through the centuries, it still maintains.

It has been thought that the name Lucerne, by which it has been known in England and France, was derived from the Swiss canton of the same name, but Coburn in the "Book of Alfalfa" considers this to be a mistake, as it was not known there until long after it was cultivated in France and England. He states that:—"The name Lucerne is probably derived from the Spanish word 'Userdas,' which the French changed to 'La cuzerdo,' and later to 'Luzerne,' still later to 'Lizerne,' and then to 'Lucerne.'"

The botanical name of Lucerne is *Medicago sativa*. It belongs to the family of leguminous plants, of which it is probably the best known and most valuable member. It usually grows from 1 to 2½ feet high, but occasionally taller. It is a deep-rooting, remarkably long-lived and prolific perennial. Under the best conditions it may be cut many times a year, and year after year. It is stated that there are lucerne fields in Mexico over two hundred years old, and others in France which are known to have been productive for over a century. There is no reason to believe that it will not be equally long-lived under Australian conditions if established on suitable soil, suitably manured, and given reasonable attention. The intensive lucerne plot referred to in the April issue of this "Journal" has been established seven years, and shows no sign of exhaustion. Its deep roots penetrate readily to 10 to 20 feet, and have been traced to much greater depths. Coburn records a case where the roots were found penetrating through crevices in the roof of a tunnel one hundred and twenty-nine feet below the surface of a lucerne field.

CLIMATE.

Lucerne loves heat, and makes its maximum growth in spring and summer. It is at its best when plentiful supplies of water are found in combination with heat. Under such conditions, which usually involve irrigation, it

is remarkably prolific, successive cuttings of luxuriant forage being obtained at intervals of five to six weeks, with an aggregate yield of 20 to 25 tons of green fodder, or, if made into hay, of six to eight tons. Owing to its deep-rooting system it is well able also to withstand extremes of temperature. The writer when in New South Wales has found it growing as far North as the Queensland border and South not far from Kosciusko. It is also well adapted to withstand summer drought. Grown experimentally without irrigation at Chapman and Merredin Experiment Farms, it has proved that it will live for several seasons through a dry summer, remaining dormant during the dry weather awaiting the summer showers or the winter rains to spring to activity.

It is believed that there is no part of the agricultural area in which this plant cannot be made to serve some useful purpose. For maximum returns for fodder or hay, irrigation will probably be necessary in most districts, but even in the drier areas sufficient information is available to indicate that it is likely to prove useful for grazing. It is anticipated, however, that its greatest usefulness will be in the Dairy Belt, and because of its great fodder value no dairyman should be without his lucerne patch.

SOIL.

Lucerne is not particular as to soil. With suitable treatment it will grow on almost all classes of soil, from nearly pure clay to light sandy soil At one time it was thought that it would only grow on rich deep alluvial soil, but experience has shown that there is hardly any kind of soil on which it will not grow provided the soil is not waterlogged or sour. The most favourable soil is a rich somewhat sandy loam, warm and friable. The highest yields are obtained with the least trouble on the very best alluvial soils found on creek and river banks well supplied with plant food and with free water from six to 20 feet below the surface. At one time the heavy clays were considered unsuitable, but cases are recorded where excellent crops have been raised on soils of this character, but more care is required in preparing the seed bed than on the friable loams. Whilst lucerne can utilise enormous quantities of water during the growing period it is killed by stagnant water lying upon it. A case is known, however, where the flood waters from the Hawkesbury River remained on the lucerne paddocks for eight days during the winter, when the roots were partially dormant, and without doing it any permanent injury. In this instance the deposit left round the plants was removed as soon as the waters receded.

PREPARATION OF SEED BED.

Lucerne likes a compact seed bed with just a little loose soil on top, and as the lucerne seed is small the soil should be well prepared. Though the lucerne plant when established is one of the hardiest of plants, yet when young it is delicate and requires favourable conditions for its support. The seed bed therefore should be warm, mellow and compact, with just a thin layer of loose soil on top. It is essential that the seed bed proper be compact, in order that the seed may germinate readily and the soil moisture move most freely in all directions to convey the necessary nourishment to the young plantlet. The compact soil in which the seed is deposited should be covered, however, with a layer of loose soil, thin enough for the small

and tender plant to force its way through, so that the evaporation of the moisture brought near the surface by the compaction of the underlayers for the use of the roots will be lessened. Because of these requirements it is generally advisable to commence the preparation of the land some time before sowing, usually by fallowing, and the ploughing can then be deep. Except in rare instances the ploughing should not be done later than at least six weeks before the seed is to be sown, for if ploughed later than this it is difficult to get the seed bed into that compact condition which is so essential for the best results with the establishment of this crop. The planting of the seed on a loose seed bed is a prolific source of failure with the lucerne crop. It is also advisable that the seed bed be as free from weeds and weed seeds as it is possible to get it, for the delicate young lucerne plant cannot compete with the hardy young weeds of a dirty seed bed, though when established it is the hardiest of plants, and but few weeds can compete with it. In its early stages weeds are very formidable and serious handicaps, and it is believed that more failures are due to the presence of weeds amongst the young lucerne plants than to any other cause.

Experimental Lucerne Plot—Merredin, 1919.

An experiment to ascertain the effect in this connection was carried out at the Merredin Experiment Farm in 1919. This experiment was planted on forest land. The plots were one fortieth of an acre in area—25 links wide and one chain long. The seed bed was well prepared by fallowing, on one plot the weeds were destroyed, on the other they were allowed to grow. The rainfall subsequent to the planting was good, and to the end of the year was as follows:—April, 302 points; May, 17 points; June, 105 points; July, 233 points; August, 164 points; September 43 points; October, 186 points; November, 38 points; December, 9 points.

The seed germinated well and, on the hand-weeded plots, the lucerne plants grew well. On 9th October the average height of the lucerne plants was 18 inches, and about one-fifth of them were in flower. It was then cut

with a scythe and weighed: the green material was allowed to remain on the plots until cured as hay, when it was again weighed. The computed yield per acre in each case were:—Green weight, 61 cwt.: hay weight, 29 cwt. 3 qrs.

On the plots which were unweeded the weeds, mainly barley grass, grew apace and so thickly that only a few plants of lucerne were visible. This weed growth was cut off at the same time as the lucerne on the other plots, after which the vegetation remained dormant until the rains in March. Some plants were then noticeable on these plots, but these were neither as numerous nor as vigorous as those on the plots which had been weeded.

The difference in the results obtained from the weeded and unweeded plots brings out in a marked manner the necessity of freeing young lucerne plants from the more vigorous weeds. It shows that as it is not a commercial proposition to control the weeds on a large area by hand-weeding, it is essential to obtain a seed bed as free from weeds as is possible by destroying them before the lucerne is planted. The importance of securing a seed bed free from weeds is so thoroughly recognised by one of the most successful growers of lucerne in the wheat belt of New South Wales that it was his practice to commence to prepare for lucerne three years before it was sown. This does not mean that the land was unoccupied for that period, but that the cropping adopted was such as would tend to destroy weed growth. As the crop is a perennial one, the thorough preparation of the seed bed necessary to make it free from weeds and compact is justified.

"Lucerne will not stand wet feet" aptly conveys the meaning of the rule that if the soil is not naturally drained to a depth of several feet, action must be taken to bring about this condition before the lucerne is planted.

SEASON TO PLANT.

In warm and particularly the dry districts of Western Australia autumn sowing, viz., in March and April, is likely to give best results, provided weeds can be controlled. Rain usually falls then and the ground is warm to ensure a good germination of the seed and a vigorous growth of the plants. During the winter plants have opportunities to make good root growth, so that the plants become strong enough to stand the hot weather of summer. On the other hand, where weed growth is troublesome, spring sowing may be advisable in cool districts with a liberal rainfall. When spring sowing is practised the ground should be fallowed in autumn or winter, so that the cultivation in winter and spring will afford opportunities for destroying weeds. This is the plan so successfully adopted in the Southern districts of Wagin, Katanning, and Gnowangerup, where considerable areas are planted for pasturing sheep.

DODDER.

Dodder is a parasitic plant vine which grows from seed. It is probably the most serious lucerne pest the grower has to face. The seed germinates in the soil and retains its connection with this until it comes into contact with the stem of the lucerne plant. It then severs its direct connection with the soil and lives upon the juices of its host, the lucerne plant, until it ripens its seed or has killed the host. Once started dodder continues to grow and

spread by means of its tendrils which grow from one plant and catch other adjacent ones. The plants first attacked begin to die and the pest spreads out in all directions.

Lucerne and dodder.

SEED.

There are several kinds of Lucerne. These are, however, types rather than varieties, and are mainly of localised character and usually distinguished by the name of the country in which they have been grown, *e.g.*, Peruvian, Turkestan, Arabian, African, etc. Many of these have been tried in Australia and at the Chapman Experiment Farm. The results obtained there are in accord with those obtained in the Eastern States, and are to the effect that none are as suitable for, or as prolific under Australian conditions, as the Australian type, which has been evolved as the result of the survival of the fittest. Growers should therefore insist upon being supplied with Australian seed most of which now comes from New South Wales. Realising the superiority of seed produced in the Commonwealth, the Federal Government now insists that all imported seed shall be stained pink, so as to make it readily distinguishable from the local seed, which in colour ranges from green to purple. Most of the seed produced in the Commonwealth is grown in New South Wales in the Hunter River, Tamworth, and Mudgee districts.

Good seed of the right kind is essential, and therefore the grower should see that he obtains it by using Australian-grown seed. The seedsmen are required to guarantee the germination and the maximum percentage of weed seeds and impurities in the samples offered. A good sample should have a germination of about 75 per cent., and should not contain more than ½ per cent. of weed seeds and also of impurities, by weight. The sale of lucerne containing dodder and other noxious weed seeds is absolutely prohibited.

The tiny seed of this pest is sometimes found as an admixture of lucerne seed, and because of the disastrous effect upon the crop precautions should be taken to prevent it being introduced with the lucerne seed which is being sown. Though some dodder seed can be separated from lucerne seed by suitable cleaning machinery, because of the difference in their relative sizes, yet, because of the vital importance of not introducing dodder, only seed which has been harvested from crops known to be free from dodder should be used.

It may be, however, that despite the precautions taken dodder has established itself. Every effort should be made to eradicate it. If very generally established probably the best way of dealing with this pest will be to plough up the paddock and grow other crops upon it for a number of years until all the dodder seeds have germinated and the plants arising therefrom have been killed. For dealing with isolated patches the usual method recommended is to mow or hoe them, cover them with straw and burn the dried material. Close and repeated grazing for some time may also prove effective, as the animals are likely to eat the dodder quite close to the ground and prevent it forming seed. Mowing has proved ineffective owing to the fact that little tendrils of the dodder plant are left on the lucerne stems near the ground and below the cut surface of the lucerne.

RATE OF SEEDING.

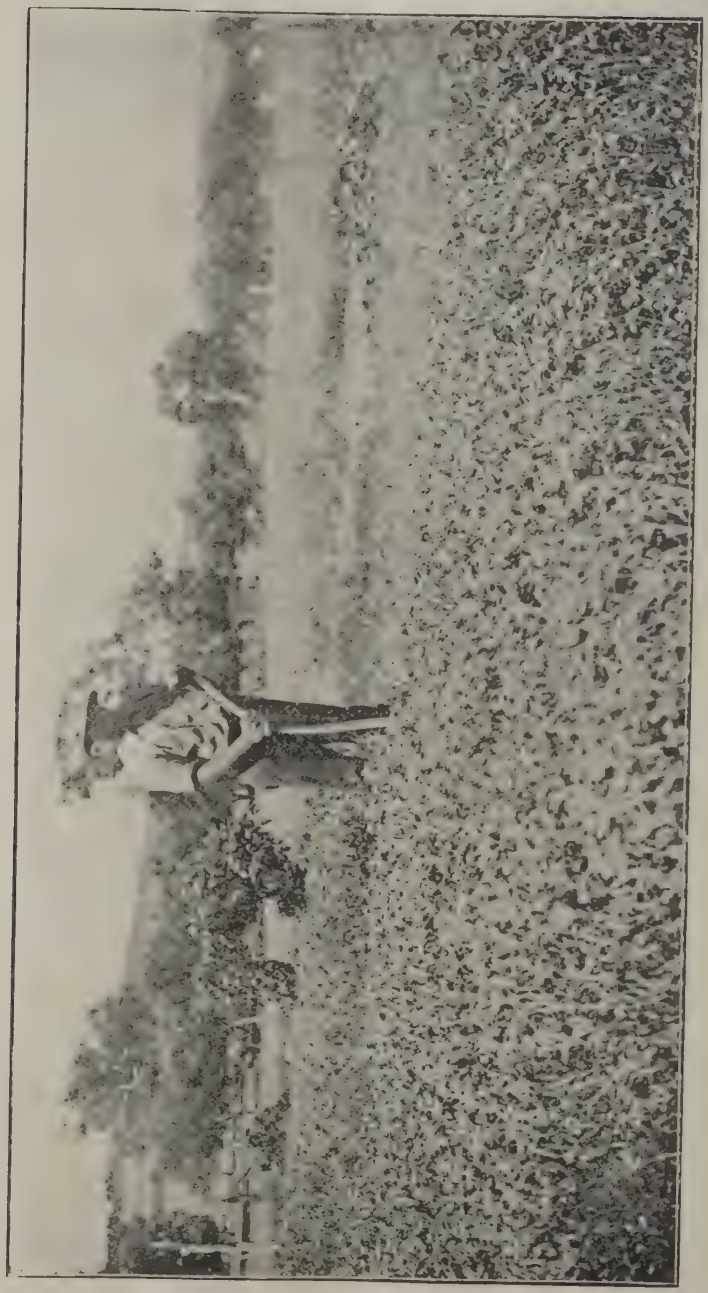
The amount of seed depends upon the purpose for which the crop is intended. For hay making purposes the amount sown by farmers ranges from 6 to 25 lbs. per acre. If, however, it is intended that the crop shall be grazed, the quantity sown is much less and ranges from two to eight lbs. per acre. In some of the lucerne-growing districts of the Eastern States the practice is to sow about 25lbs. of seed per acre, and growers have been known to state that they would prefer to sow 30 rather than 20 lbs. per acre.

This attitude is due to a realisation of the fact that many causes operate against plants succeeding and prevent more than a small percentage of the seed from producing healthy established plants: the young seedlings are tender and have difficulty in reaching the surface after germination. During the process of covering many of the seeds sink too deeply into the soil, whilst many remain quite near or on the surface and fail owing to insufficiency of moisture. Further, whilst the lucerne crop is being established a process of elimination occurs, weeds rob the soil of the fertility, use up moisture and compete with the lucerne for light. This makes the plants thin and spindly and generally saps their vigor, and in consequence it is only the strongest plants which survive.

It is considered that when established a stand of some 500,000 plants per acre is ample. Seeing that 1lb. of lucerne seed contains about 220,000 seeds, the use of from 2 to 3 lbs. of good seed per acre would meet these requirements, and though it is recognised that a farmer should not run the risk of a thin crop as the result of being niggardly with the seed, it is considered that the use of 6lbs. of good seed on well prepared land allows for the many contingencies referred to, and that to use more than 12lbs. is unduly extravagant.

METHOD OF SOWING.

Except on loose drifting sands lucerne should not be sown with a nurse crop. There is general agreement amongst experienced lucerne growers that if lucerne succeeds with a nurse crop it is in spite of the additional drain



Lucerne at Nabawa. Grown by Mr. S. E. Gould.

upon the soil moisture instead of by reason of it. This is particularly applicable to dry climates, for when there is only a limited supply of moisture available, all this will be required to germinate the seed and give the young plant a vigorous start in life.

The seed is usually broadcasted and should be sown near the surface. The seed may be broadcasted either by hand, by a hand broadcasting machine of the "Caloon" or similar type, or through the grass seeding attachment of the ordinary grain and fertiliser drill. An even distribution of seed is desirable: it is not easy to obtain this by broadcasting with such small quantities of small seed. When necessary to sow by hand it is convenient to follow behind a roller or harrow, so as to have a clearly defined area on which to sow. The small quantity of seed used is dealt with by using the finger and thumb instead of the whole hand for picking up and spreading the seed, and sometimes to facilitate the work and ensure more even distribution the seed is mixed with dry soil or ashes. When the hand machine is used a small quantity of seed can be sown best by turning the handle the opposite way to the usual one. The seed can be sown down the seed box of the grain and fertiliser drill if mixed with some bulky material like bran. It is sometimes mixed with superphosphate and sown through the fertiliser box, but this method is not recommended on account of the destructive action of the fertiliser on the vitality of the seed. When sowing the seed through the "shoes" of the grain drill there is some risk that the seed may be planted too deeply, but provided this risk is known it can be guarded against and avoided. When sown down the tubes of the grain drill the seed can be deposited on the surface by removing the tubes from the "shoes," and at the same time a broadcasting effect can be obtained by arranging for the seed to be dropped on to a sloping board fixed with an inclination of about 30 degrees to the ground.

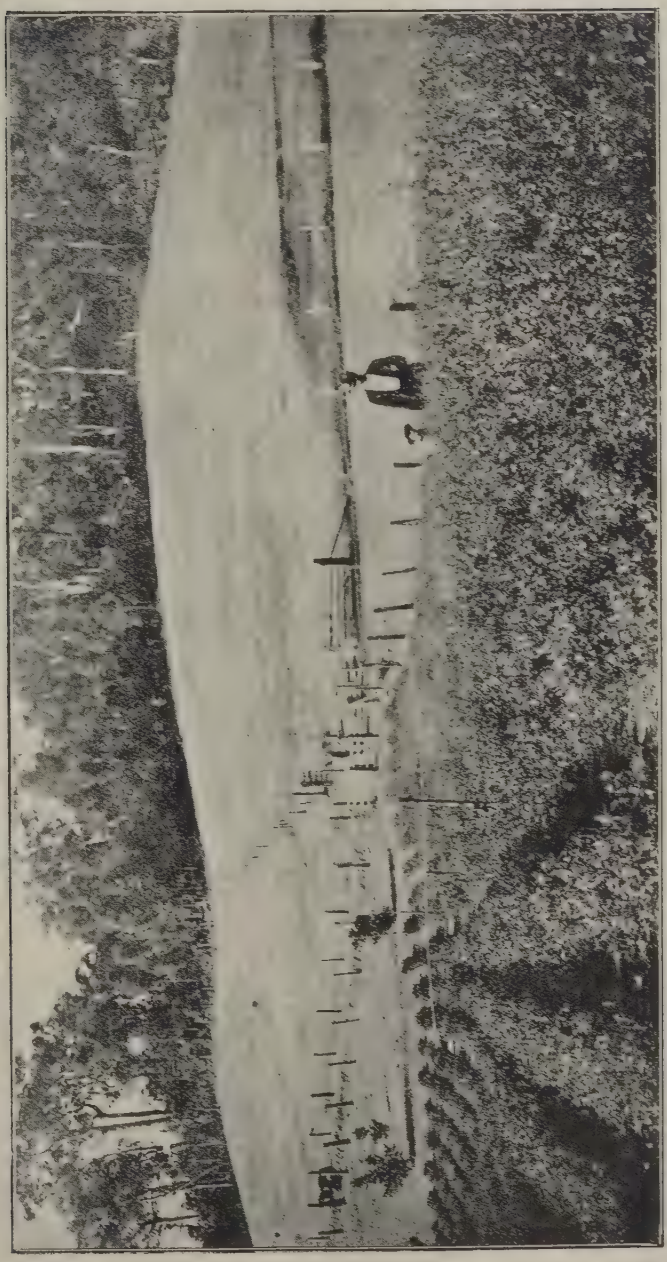
The seed is sometimes sown in drills which are far enough apart to admit of intertillage. This method is believed to be the best for dry districts, and particularly for places where weeds are troublesome and for small patches. It is further recommended as the method to be adopted when determining the suitability of new locations for this crop. The results obtained by Mr. A. C. R. Loaring at "Lawnbrook," Bickley, with lucerne in drills 2ft. 9in. apart, and recorded in the April issue of this "Journal," prove that there is no need to fear lessened yields from the adoption of this method, and it has several distinct advantages. It enables the land between the rows to be kept loose by cultivation, as the result of which loss of soil moisture by evaporation is reduced to a minimum, and the water is conserved for the use of the crop. Another advantage is that the cultivation given to conserve the moisture also destroys weeds, thus preventing the crop from being robbed of the plant food and moisture which the weeds would use for their growth. It has the further advantage that a saving of seed is effected when planting in this way, for assuming that only 50 per cent. of plants were obtained from the seed planted, 2lbs. of seed will provide 15 plants per foot of row if the rows are 3ft apart. The seed is covered either by rolling or by harrowing with a light or brush harrow. It is best covered by the joint operations of both rolling and harrowing. The rolling presses the seed into the soil, and in this way the germination is assisted: it is, however, undesirable to leave the surface compacted and smooth as left by the roller, for this tends to draw the moisture to the surface where it can be evaporated, and in addition a rolled surface crusts readily after a shower. These disadvantages can be overcome by lightly harrowing the rolled surface.

INOCULATION.

Lucerne, in common with other Legumes, is able to obtain the nitrogen for its requirements from the free nitrogen of the air, and of which it forms 80 per cent. It does this with the aid of certain vegetable organisms which derive their sustenance from the nitrogen of the air and the starch of the plant. When acting in this way the presence of these bacteria can be noticed by the appearance of wartlike nodules or tubercles on the roots. The nodular swellings are fitted with the micro-organisms and are usually in clusters. Some are as small as a pin's head, others as large as a pea. It was thought at one time that each legume—lucerne, clover—had a distinct organism, but now it is believed that legumes of closely related kinds have the same organism, and will pass from one kind to another. Thus instead of, as originally considered, a distinct kind of bacteria was required for clover and another for lucerne, it is now believed that the bacterium found on clover can adapt itself to lucerne. These nitrogen collecting bacteria do not act when there is an abundance of nitrogen in the soil available for the use of the legumes. They, so to speak, become lazy.

Seeing that in soils deficient in nitrogen lucerne will be dependent upon the presence of nitrogen-gathering bacteria for its supplies of nitrogen, it follows that if they are not present its development will suffer and will be shown by the pale colour of the foliage. It is important, therefore, to have these organisms in the soil; in fact lucerne cannot be a complete success without them. Fortunately there is no record of their absence in any place where lucerne has been tried, to date, in Western Australia, and because of the manner in which clovers flourish throughout this State there is every reason to believe that they will be present naturally right throughout the agricultural areas. If, however, they should prove to be absent, they can be introduced, and this process is called inoculation. The most generally adopted method of carrying out the inoculation has been to distribute over the new land intended for lucerne a small quantity of the surface soil from an old established lucerne patch. Soil containing or infected with the required bacteria, at the rate of about 100 to 200 lbs. per acre, is harrowed in with the seed or just before sowing. The danger attendant upon this method is the risk of introducing weed seeds, fungus diseases, or ellworms. Another method without the same risk is the distribution of finely cut up or ground lucerne hay with the seed or the feeding of lucerne or clover hay to the stock some time before the seed is to be planted.

It was found that these nitrogen-fixing bacteria belonging to the different groups of legumes could be isolated and prepared for distribution in convenient form as "Nitroculture." This scientific discovery was developed to such an extent that "cultures" for the different legumes were placed upon the market. Little success attended the venture, and the application of "cultures" to leguminous plants made little headway beyond the experiment stage. It is believed that this is due to the fact that in most soils there are sufficient of the necessary micro-organisms for at least a starting point, and that under the other conditions essential for success with legumes, they will multiply rapidly enough to meet plant requirements after those of the young plant have been met. Because the young plant requires to obtain its early nitrogen requirements from the soil an application of nitrogenous manure—sulphate of ammonia, blood, or nitrate of soda—is recommended for sandy soils or others deficient in nitrogen-forming material.



Lucerne in Drills—"Pawnbrook," Bickley.

The effect of lime is to encourage the growth of these bacteria. If the crop is not suffering from excess water, and there are evidences—such as the pale colour of the leaves, or the absence of the nodules on the roots—that the necessary bacteria are not functioning, mild lime at the rate of about one ton to the acre should be applied. On sour and sandy soils a similar dressing of mild lime is also recommended to be applied at least one month before the seed is sown. In addition to stimulating the bacterial activity already referred to, it will also have the effect of correcting the acidity which is so detrimental to success with lucerne.

Lucerne at Wagin. Grown by Mr. G. A. W. Piesse.

MANURING.

Lucerne is a heavy feeder. Under suitable conditions twenty tons of green crop may reasonably be expected in a season, and this would contain about 340lbs. of nitrogen, 60lbs. phosphoric acid, and 250lbs. of potash. Fortunately, except during the period immediately following germination, this plant is not usually dependent upon the soil for its nitrogen supply. Being a legume it can, when suitable bacteria are present, obtain all its requirements in this connection from the inexhaustible supply contained in the air. But the phosphoric acid and potash must be obtained from that already in the soil or from fertilisers applied to the soil. On fertile loams it may be assumed that the soil will contain sufficient nitrogen to meet the

requirements of the young lucerne plant, and supply its needs until the necessary bacteria are sufficiently plentiful to enable it to secure all it needs in this connection from the air. Guided by experience in the Eastern States, it is also unlikely that except in sandy soils potash manuring will be necessary in the early stages, but it is equally likely that manuring with phosphoric acid will be followed by marked beneficial results. An application of from 2 to 3 cwt. of superphosphate per acre is recommended on all soils, even the best.

On loams poor in organic matter it will be advisable to supplement the superphosphate with an application of sulphate of ammonia up to 100lbs per acre, so as to meet the requirements of the plant for nitrogen until it is sufficiently established to obtain what it needs from the air. On such soils the fertiliser recommended is therefore:—superphosphate, 3cwt. per acre; sulphate of ammonia, 1cwt. per acre. The fertiliser recommended for sandy soils or those deficient in plant food is a mixture of:—sulphate of ammonia, 100lbs.; superphosphate, 400lbs.; muriate or sulphate of potash, 400lbs.

Except in soils unusually rich it will be necessary to fertilise it annually. Subsequent applications of fertilisers should be governed largely by the returns aimed at or secured. If the soil is not rich enough for its latent fertility to be drawn upon, or if it is desired to replace the plant food removed by the crop, then an application of superphosphate 14lbs., sulphate or muriate of potash 25lbs. is recommended for every ton of green lucerne removed.

Well saved stable manure is very suitable for this crop, for in addition to the plant food it contains it also supplies organic matter to the soil, and this improves its mechanical condition. If kept on the surface it acts as a mulch to conserve the moisture and will be of considerable assistance in preventing the formation of a crust on its surface. The great drawback is the weed seeds it contains, for these, unless killed as the result of rotting, are likely to destroy the young lucerne plants. This objection is therefore lessened when the manure has been well rotted and is not serious when applied to well established lucerne beds.

On sour and sandy soils a dressing of air slaked lime or ground stone at the rate of 20cwt. per acre is recommended as a preliminary dressing to be applied at least one month before the seed is sown. This will have the effect of correcting acidity and stimulating bacterial activity.

TREATMENT AFTER SOWING.

Even in the best prepared soil weeds are likely to spring up, for most soils, and particularly old and fertile ones, contain dormant weed seeds, and these germinate with the lucerne seeds and become a menace to its success. It is not possible to cultivate the ground to destroy the weeds which may grow amongst the recently-planted lucerne, for in its young state it is so delicate and with so little roothold that even a harrowing is likely to pull out or damage a considerable number of plants. Lucerne planted in the autumn will rarely be strong enough to be cultivated before the following spring, or that sown in spring before the following autumn. Short of hand-pulling, which is only possible on small areas, the most practical method of controlling weeds in young lucerne is to mow or graze them. If this latter plan is followed the grazing should be done with small stock and as quickly

as possible. The mowing can be commenced when the lucerne plants are four to five inches high, and repeated after a short interval, say a month. This mowing, though detrimental to weed growth, will not injure the lucerne, but rather will stimulate it. Usually the material from the first mowing will not be worth gathering, and it can therefore be left, with advantage, to mulch the ground. As the object of this mowing is to destroy the weeds it should be undertaken whenever they are plentiful enough to warrant it, irrespective of the condition of the lucerne plants and the necessity for utilising the crop. It is emphasised that mowing does not injure but stimulates lucerne. When the young plants have a firm roothold, and this can be determined by pulling at them, cultivation of the soil can take place with advantage. Its effect will be to stimulate the crop by letting air into the soil for the benefit of the nitrogen-fixing bacteria, and by conserving the soil moisture. For the first cultivation a light harrow is probably the best implement to use, but as the lucerne gets older much stronger implements, such as the springtooth cultivator or disc harrow can be used. One of the best implements for the purpose on established lucerne—over two years old—is the disc harrow. To one not accustomed to its use it may be thought that it will destroy the lucerne as well as cultivate the soil. This, however, is not so. The discs should not be given too much angle, and they will then split the lucerne crowns and cause them to throw up additional stems.

When the soil of an established lucerne bed becomes hard it can be disced and cross-disced to loosen it up with most beneficial results. There need be no fear that surface cultivation will kill the plants, as they are too deeply rooted to be injured, and the splitting of the crowns is beneficial. Discing and cross-discing is extremely useful should the paddock unfortunately become infested with couch grass. On one occasion the writer had occasion to deal with such a paddock, and so badly infested was it that the treatment decided upon was desperate and almost in the nature of a forlorn hope. The ten-acre paddock was double disced twice both ways. The result was astonishing. The lucerne grew with such astounding vigor as to keep the couch under control when aided by the usual periodical cultivations with the disc, and because of its success many additional acres of lucerne were planted on the farm.

FEEDING LUCERNE.

Lucerne as a food is particularly valuable for the protein it contains. Henry gives the average digestible nutrients in freshly cut lucerne and green fodder maize as:—

	Digestible nutrients per 100lbs.		
	Protein.	Carbo-hydrates.	Fat.
Green fodder maize ..	1.0	11.6	0.4
Green lucerne	3.9	12.7	0.5

From this it will be seen that green lucerne contains nearly four times as much protein as green maize.

The nutrient protein is the most expensive of our food constituents and is essential for the production of lean meat, wool, milk, and eggs. Young animals, cows in milk, and laying hens require much protein, and because of the large amount of protein which it contains lucerne is very suitable for these animals. It can in many instances profitably take the place of bran

or oilcake in the ration, particularly of milking cows, and which farmers may have to purchase in order to profitably and economically utilise the other products of the farm, or to maintain a continuous milking period.

Comparative analyses of bran and lucerne hay, as given by Henry, are as hereunder:—

	Digestible nutrients per 100lbs.		
	Protein.	Carbo-hydrates.	Fat.
Lucerne hay	11.0	39.6	1.2
Wheat bran	12.2	39.2	2.7

From the above the similarity between the two is obvious, and it is estimaeted that in practice 11lbs. of good lucerne hay is equal to 10lbs. of bran. In one respect lucerne has a very decided advantage over bran, and that is as a food for pigs. Lucerne is one of the best foods and bran one of the worst for these animals. In the United States of America large numbers of pigs are regularly pastured upon lucerne, and in this connection it is estimated that a vigorour patch of lucerne will carry 15 to 25 pigs per acre, and the pigs will make a gain of about 100lbs. during the season. Whilst grazing lucerne with pigs it is best to supplement it with an allowance of grain, like maize or wheat. For fattening purposes lucerne will not be found economical if fed alone, for when fed alone all its protein cannot be digested and though they increase in weight such increase is principally of bone, blood, and muscle. For fattening animals lucerne requires to be supplemented with foods like maize, wheat, and oats and other foods richer than lucerne in carbo-hydrates and fat.

HAYMAKING.

The object of transforming the green material into hay is to get rid of excessive moisture so that the hay when stacked will not heat too much or become mouldy.

Lucerne is much more difficult to make into hay than the cereals. This is because of the very sappy character of the stems, which do not dry as readily as the leaves. These latter are the most nutritious part of the plant, and if they become very dry are likely to fall off the stem during the operations of haymaking. The great object to be achieved therefore is to regulate the drying as far as possible so that the leaves and stems dry simultaneously. The principle underlying the procedure necessary for this is founded upon the fact that the leaves until they are so dry that they cease to function will transpire quite a lot of water and which they will draw from the sappy stems. The methods to be adopted should therefore aim to keep the leaves limp as long as possible, as whilst in this condition they will be drawing sap away from the stems very effectively. In practice the hay is made as far as possible in the windrows or in heaps or "cocks."

Lucerne may be cut at any time for green feed, and it may be accepted as an axiom that it is better at all times to cut early than late. Some farmers commence to cut the crop for hay shortly after the first flowers have appeared, others when the lower leaves begin to change colour, in some instances this latter may happen and the leaves begin to drop and the stems harden before the blooms appear. Unless the weather is very unsuitable for haymaking the mowing should not be delayed or loss may occur in three

ways; in the first place the later cut or more mature material is less digestible, for after flowering the food constituents are transferred to the upper portions of the plant, the stems harden and become less digestible than when younger; in the second place some of the leaves wither and drop off and this results in loss in weight, and finally, deferred cutting leads to poorer growth in the succeeding crop and may also result in a lessened number of cuttings during the season because of the greater time which the respective cuttings occupy the land.

Lucerne at Denmark. Grown by Mr. J. Haine.

The following table showing some results obtained at the Utah Experiment Station in a feeding test indicates the loss of nutriment following upon delay in cutting.

Stage of growth and beef lbs. produced per ton—

When 1-10 in bloom—706.

When in full bloom—562.

When 1-2 of blooms have fallen—490.

At the Kansas Experiment Station results obtained and the decline in the protein content consequent upon later cutting are as follow:—

Stage of growth and protein content—

When 1-10 in bloom—18.5 per cent.

When 1-2 in bloom—17.2 per cent.

When in full bloom—14.4 per cent.

The first cutting for hay is ready early in spring, and except in the wheat areas this crop will be difficult to make into hay on account of its sappy nature and the lack of much sun heat at this time. If this cutting can be used for feeding to stock in its green state it is advisable to use it in this way. The second and succeeding crops are much more easily converted into hay. In New South Wales when a crop of seed is required the third crop is usually utilised for this purpose, as the flowering at this period is usually more uniform than at others.

Lucerne is usually mown with a scythe, mowing machine, and on occasions with a reaper and binder; it should be cut as close to the ground as is possible without injuring the blade, so as to get the maximum amount of material and to force the new growth from the crown instead of from the joints of the old stems. The usual practice is to start when fine bright weather is expected and as early in the morning as is possible, but not until any dew which may have been deposited has evaporated. It is undesirable that the cut material be allowed to remain in the swath too long, especially if the weather be hot, for extreme heat causes rapid drying of the leaves, and these are likely to fall off during the subsequent operations. If it is allowed to remain just long enough to wilt during bright fine warm weather, this will take only a few hours, whereas with cool moist conditions it may take as many days. After being wilted the material should be raked at once into windrows. If the day is a bright sunny one and the mower has been started in the morning, the rake can be started at mid-day, and should catch the mower before night. The next morning the material in the windrows can be placed into heaps or "cocks," and if the weather remains favourable it is probable that the lucerne will be fit to stack the following morning.

Sometimes during hot weather the curing is completed entirely in the windrows, which should be made loose so as to admit the air freely, but in cool damp weather it will be advisable to place the material in "cocks" and allow the curing to finish in them. When dry enough or "cured," the hay is ready to be carted for stacking or baling. This is determined by an examination of the stalks, which need not be dry and brittle, but tough, though without any sap being noticeable when the stems are twisted tightly.

Just before carting the "cocks" are sometimes turned over to expose the bottom hay for an hour or so to the sun, so as to dry off any hay that may be slightly damp owing to its proximity to the ground. Sometimes in very hot weather the hay becomes too brittle as the day advances, and there is a danger of losing the leaves, and the carting has to be confined to the mornings.

The time occupied from mowing to carting will vary with the season and according to the weather prevailing during the operations. Usually it is under three days, but may be as short as 24 hours. An extreme case is that of Mr. P. Reynolds, "Hobartville," Richmond, who on one occasion stacked his hay in the shed 16 hours after cutting.

Lucerne hay does not shed the rain well, and when stacked in the open should be thatched or protected in some other way from rain. It is best stored in sheds, and should not be stacked on the ground or on a raised straddle of earth; it requires a foundation or straddle of poles to admit air to the bottom of the stack. If stacked on the ground some is sure to spoil.

SUMMARISED.

Lucerne has many virtues, these have been summarised in most picturesque language by Geo. L. Clothier, of whom it is stated by Coburn in the "Book of Alfalfa" that he has studied his subject closely in the field, in the feed lot and the laboratory. His summing up is as follows:—

"The cultivation and feeding of alfalfa mark the highest development of our modern agriculture. Alfalfa is one of nature's choicest gifts to man.

Lucerne under Irrigation, 26 days from last cutting. S.W. District.

It is the preserver and the conserver of the homestead. It is peculiarly adapted to a country with a republican government, for it smiles alike on

the rich and the poor. It does not fail from old age. It loves the sunshine, converting the sunbeams into gold coin in the pockets of the thrifty husbandman. It is the greatest mortgage lifter yet discovered.

"The alfalfa plant furnishes the protein to construct and repair the brains of statesmen. It builds up the muscles and bones of the war-horse, and gives his rider sinews of iron. Alfalfa makes the hens cackle and the turkeys gobble. It induces the pigs to squeal and grunt with satisfaction. It causes the contented cow to give pailsful of creamy milk, and the Shorthorn and white-faced steers to bawl for the feed rack. Alfalfa softens the disposition of the colt and hardens his bones and muscles. It fattens lambs as no other feed, and promotes a wool clip that is a veritable golden fleece. It compels skim-milk calves to make gains of two pounds per day. It helps the farmer to produce pork at a cent and a half a pound and beef at two cents.

"Alfalfa transforms the upland farm from a sometime waste of gullied clay banks into an undulating meadow fecund with plant food. It drills for water, working 365 days in the year without any recompense from man. The labour it performs in penetrating the subsoil is enormous. No other agricultural plant leaves the soil in such good physical condition as alfalfa. It prospects beneath the surface of the earth and brings her hidden treasure to the light of day. It takes the earth, air, moisture and sunshine, and transmutes them into nourishing feed stuffs and into tints of green and purple, and into nectar and sweet perfumes, alluring the busy bees to visits of reciprocity, whereon they caress the alfalfa blossoms, which, in their turn, pour out secretions of nectar fit for Jupiter to sip. It forms a partnership with the micro-organisms of the earth by which it is enabled to enrich the soil upon which it feeds. It brings gold into the farmer's purse by processes more mysterious than the alchemy of old. The farmer with a fifty-acre meadow of alfalfa will have steady, enjoyable employment from June to October for as soon as he has finished gathering the hay at one end of the field it will be again ready for the mower at the other. The homes surrounded by fields of alfalfa have an esthetic advantage unknown to those where the plant is not grown. The alfalfa meadow is clothed with purple and green, and exhales fragrant balmy odours throughout the growing season to be wafted by the breezes into the adjacent farmhouses."

SELL SURPLUS COCKERELS.

Careful experiments have shown that to obtain the first lb. of gain in a cockerel requires 3½lb. of dry food matter, the second lb. of gain requires 3.8lb. of feed, thence onward 4.0lb., 4.1lb., 4.4lb., 6.4lb., 9.2lb. until to get the eighth lb. of gain no less than 19.6lb. of feed is required. Thus it rarely pays to keep the male bird over 4lb. in weight, and in most cases the 2lb. mark is much the more profitable. One successful egg farmer near Sydney markets his cockerels almost as soon as he can recognise them as such, and he claims to make a net profit of £500 per annum from 1,000 laying hens, and can produce his balance-sheet to prove it.

EXPERIMENTS WITH LUPINS AT THE CHAPMAN EXPERIMENT FARM.

I. Thomas,

Superintendent of Wheat Farms.

The blue flowering lupin has firmly established itself in the Northern agricultural areas adjacent to the coast. It suits the conditions so well that it is found making good growth on uncultivated as well as on cultivated land. In these areas it grows so strong and spreads so rapidly that at one time, not so very many years ago, fears were entertained that it might prove a troublesome weed, and that it ought to be eradicated lest it interfere with the harvesting operations. This fear no longer exists. It was soon found that this plant was easily controlled and could be eradicated by cultivation and with the aid of sheep, and at the present time it is encouraged to grow to the extent of sowing the seed with the wheat and oat crops. The main reason of this practice is that with their aid the sheep carrying capacity of the farm can be increased, for they afford an easy and natural method of conserving a good stock food until summer, when the usual pasture is very often scanty. When very young sheep will eat and destroy them, and this enables them to be controlled, but when a little older, and as they become well rooted they seem to become less palatable to stock, for, provided there is other feed available, sheep will not touch them until mature, when they eat the seeds readily and do well on them. Thus a very valuable food can be readily conserved from the plentiful to the scanty period. Further, its vigorous growth provides a very considerable amount of vegetable matter which, after being grazed, increases the quantity of organic matter in the soil, and as the lupin is a leguminous plant it also enriches the soil by adding nitrogen to it.

Leguminous plants and sheep must play a very important part in the improvement of our lighter lands, and as the lupin has proved itself so vigorous and hardy and adapted to light land, it was determined to carry out some experiments with the object of ascertaining what farm practices are likely to be most successful in connection with the cultivation of this crop.

The first experiment was designed to ascertain whether seeds planted on the surface or at depths of one or three inches germinated best, the second to determine whether the application of a potash fertiliser in addition to the superphosphate was beneficial, the third whether liming was beneficial, and the fourth whether inoculation with infected soil was attended with good results. The soil on which these experiments were conducted was a light red sandy loam, from which small Jam trees (*Acacia acuminata*) had been cleared several years previously. The land had been in crop and fallowed in alternate years since 1917. It was ploughed during the winter of 1923 to a depth of 6 in., and had been cultivated as required during the spring to destroy weeds. At the time of planting the ground was in excellent tilth, free of weeds and moist.

A sketch of the arrangement of the different sections of these experiments is shown hereunder:—

Not Inoculated.	Inoculated.
Depth of Planting Experiment.	
Fertilizer Experiment Limed.	
Fertiliser Experiment Unlimed.	

The experiment to ascertain the most suitable depth to plant lupin seed was sown on 7th May. Each plot consisted of two drills three feet apart. The drills were three chains long and 400 seeds were planted in each, or about six inches apart. On plot 1 the seeds were planted on the surface and covered lightly with soil. On plot 2 they were pressed into the ground to a depth of one inch with a dibber made for the purpose, and on plot 3 to a depth of three inches with a similar dibber. The series of the three plots planted at different depths was sown in triplicate. As the seeds germinated the plants were counted from time to time until it was found that germination had definitely ceased. The result of the final counting is as in the table hereunder:—

LUPINS.

Depth of Planting Experiment.

Results of Germination.

Seeds planted.	No. of seed planted per plot.	Number of Seed germinated.			Total number of seeds germinated.	Percentage germinated.
		1st plot.	2nd plot.	3rd plot.		
On surface	400	145	113	136	394	32·83
One inch deep ...	400	178	168	137	483	40·25
Three inches deep ...	400	70	86	77	233	19·41

The germination was not good on any of the plots, but is strongly and consistently in favour of shallow planting. As the blue lupin seed is a large one, this is somewhat surprising. The results are, however, so definite that it must be concluded that lupin seed is best sown just below the surface The fact that comparatively good results were obtained when sown on the

surface has an important bearing on possible farm practice, for it indicates that lupin seed may be sown amongst the wheat or oat stubble and good results obtained even if the ground is too hard, as it may be in summer, for the drill to penetrate. This was actually confirmed by an experience in the adjoining paddock, where lupin seed was planted in stubble on 9th June, with the ordinary 15-disc drill, and on ground that was so hard that the discs made little or no impression, so that the seed was not covered. Owing to the late planting, the germination was slow but satisfactory, and the results are encouraging. Further, they indicate that good results may be expected from seed self distributed by plants sown the previous season amongst oats or other fodder crops.

The trial with fertilisers was planted on the same date as the previous one. As the result of general farm experience it was assumed the soil needed an application of superphosphate, all the plots in the experiment received an application of superphosphate, containing 22 per cent. P_2O_5, at the rate

Lupin.

Showing the advantage of early sowing. The large plant is the early sown plant in a plot which had to be re-sown. The small plants are the later sown.

of 95lbs. per acre, but in addition alternate plots received an application of 35lbs. per acre of sulphate of potash containing 50 per cent. K_2O. Each plot consisted of a set of three drills, three feet apart, the centre one of which it was intended should be used for the purposes of comparison. Each series of the two plots was repeated eight times, four of these were limed, the remaining four being without lime. In this experiment the seed was planted with a maize drill about two and a half inches deep, this being considered reasonable on account of the size of the seed. The germination was so poor as to render this experiment a failure, the poor germination as dis-

closed by the previous experiment being due to the seed being planted too deeply. Because of the poor germination attending the first planting the plot was resown a month later with the ordinary grain drill using the "oat" side of the seed chamber. The germination was satisfactory, but the growth of the plant was disappointing and not nearly as vigorous nor as great as in the previous experiment. As the result of the closest examination no material difference could be determined between the plots receiving the potash fertiliser, and those without it. The plots were so uniform and the plants were so small that it was decided to be unnecessary to weigh the results from each plot as was originally intended.

In these plots some of the plants from the first sowing survived the second, there was a marked difference between the size of these and those of the second planting as may be seen from the illustration herewith. This difference as noticed in the field was so striking as to emphatically point out the importance of early planting, and indicating that early planting is one of the essential factors of success with this crop.

Lupin Plots.

Soil inoculated. Soil not inoculated.

As already stated half the plots in this experiment were limed, they received a dressing of air slaked lime at the rate of 15cwt. per acre. As far as could be discovered the liming made absolutely no difference to the growth of the lupins, though it was found that the weed growth on the limed plots was greater and more difficult to control than on the unlimed ones. It can only be concluded that the lupin does not specially need lime when planted on this kind of soil.

For the purpose of the fourth experiment, viz., to ascertain the effect of "inoculation" on the vigor of the lupin, all the other experiments, which were planted contiguous to each other and running from North to South,

were divided into two portions at right angles to the direction of the drills, and the Eastern portion was inoculated by scattering over this portion soil taken from an old lupin bed in the grass garden, and in which the roots of the previous lupin crop were known to be liberally supplied with nodules.

Root of Lupin plant showing the nodules containing the nitrogen-fixing bacteria.

The quantity of infected soil applied was at the rate of about 200lbs. per acre. As with the lime and fertiliser experiments, no perceptible difference could be noticed between the two portions, even after the closest scrutiny. The absence of difference between the "inoculated" and uninoculated sec-

tions may be seen from the illustration. The crop on the left of the centre of the illustration received the dressing of infected soil. The roots of typical plants from both sections were examined and found to possess nodules though very little difference was noticeable between the quantity on the respective roots, but those from the inoculated plot appeared to be very slightly larger than those from the other. As far as is known this land had not had lupins growing upon it, but it would appear that the soil contained the necessary bacteria to meet the requirements of the lupin. The nodules as found on the roots of a plant from the uninoculated section are shown in the illustration herewith.

Summarised, the conclusions from these experiments are:—

(1) That shallow planting is essential, and in consequence success can be expected from self-distributed seed from plants grown in the previous crop or from seed drilled amongst the stubbles.

(2) For best results the seed must be sown early in the season.

(3) That the addition of potash to superphosphate on light land of this type is not beneficial to the lupin.

(4) That liming is also unnecessary.

(5) That this soil is sufficiently supplied with nitrogen gathering bacteria to meet the requirements of the lupin plant.

In addition to the experiments just described, fifty new varieties of lupins obtained from Germany through the courtesy of Mr. J. M. Hattrick of the Potash Supply Company, were planted and a preliminary comparison made with the local blue lupin. A number of these new varieties are described as being suitable mainly for ornamental purposes. A row containing one hundred seeds of each variety was planted on 19th June as soon as received, and in a similar manner to those planted in the other experiments. Every sixth drill was sown with the local blue lupin as a control or check row. The germination of most of the varieties was good, but owing to the lateness of the planting the growth was slow, as was also that of the local variety. At the end of September the local blue variety had made decidedly better and more vigorous growth than any of the new ones, but since then, however, some of the new varieties have improved and are almost as good as the check rows. It is intended to carry out a thorough test with these varieties next season using the seed now being produced by them.

THE PIG'S TAIL.

The curl in the pig's tail is said to be a sure indicator of the state of his health. Some breeders assert that a straight-tailed pig is discontented and a feed waster. In health, the tail is curled and carried in a characteristic way, whereas in a sickly animal the tail is often carried loosely and hangs in a limp fashion. One will often notice, however, that in aged pigs the tail is not always curled. Sometimes it hangs free and is switched about in the same way as the tail of a horse or cow. Even in these cases, the way in which the tail is moved indicates whether the animal is in good heart or is sickly and disinclined to move about.

THE ROYAL SHOW, 1924.

The Department's Contribution.

The pavilion of the Department of Agriculture has for many years been the Mecca towards which farmers visiting the Show have turned. The bunting and other decorations might, and undoubtedly did, attract those who were not specially interested in farming, but the man on the land knew that within the building he was sure to see much that would be of service to him. The whole purpose of the Department's display was educative, and in all the branches this idea this year, as heretofore, was expressed in practical fashion.

The wheat section was represented by an attractive and educational exhibit placed on an island stand. This exhibit was so designed as to illustrate two of the principal factors in connection with the production of successful crops on business lines. The two central features were a series of photographs dealing with the preparation of the seed bed aptly called "The Cradle of the Crop." This comprised a series of photographs, the centre one of which was in the form of a cradle, and consisted of a coloured photograph depicting well prepared fallowed land. Around this central photograph were other photographs illustrating the evolution of the "cradle." The photographs illustrated the various methods of the initial operation of ploughing, stating when it should be carried out, the later operations of cultivating and feeding off with sheep, and, finally, the seed being placed in the "cradle." The other central feature illustrated the production of pure clean pedigree seed, and by means of diagrams there was shown the method of producing it from one solitary grain to the field crop of many acres, which, after having been graded, is sold to the farmers to meet their requirements. Intermingled were graphs showing the result of the year's work carried out at the Chapman and Merredin Experiment Farms, and by means of which the visitor could obtain exact information as to the most suitable time to plough the ground, the depth to plough, the rate of seeding, the time to sow, the quantity of manure to apply, and also whether it was necessary to treat the seed to prevent smut or not, and, if so, the most satisfactory method for doing this. The bags of graded seed as supplied by the experiment farms flanked the base at the centre of the structure. Of interest to the general visitor were the graphs in the form of thermometers: the one headed "The Progress of Enterprise" showed the marvellous development of the area under crop in this State, due to the enterprise of our pioneer settlers; the other depicted the area fallowed for cropping year by year since the war. The increase which is taking place in this connection is "The Rising Line of Improvement."

The fruit exhibit was very attractive, whether viewed from its artistic or commercial aspect; highly coloured Dougherty Yates and other varieties contrasting with the yellow of Dunn's Favourite and the greenish tinge of Granny Smith. Oranges were represented both as individual specimens and packed for export. In the latter it was interesting to note that the trays displayed contained two dozen fruits similar to those exported this season which realised 6s. to 8s. each in London. Chanez grapes, packed in granulated cork as put up for export, were still sound and hung firmly on the bunches in spite of six months having elapsed since date of picking. Pears, another

Department of Agriculture Pavilion, 1924. Wheat Display: "The Cradle of the Crop."

soft fruit not usually on hand in October, were shown in beautiful condition; one variety—Winter Nelis—being as firm as the day the fruit was gathered from the trees. Raisins, sultanas, and currants were interspersed in attractive glass-fronted packages throughout the display; all were good commercial samples of what was produced last season in this State, but a meed of special praise must be paid to the currants, which were acknowledged to be of higher quality this year in Western Australia than in any other State of the Commonwealth. Photos depicted orchard and vineyard scenes in various portions of the fruit-growing districts in the State, and there was also shown the area under fruit, the production and the quantity exported.

It is universally regarded as being extremely desirable that such an industry as viticulture should receive more attention from agriculturists in Western Australia in the future than has been the case in the past. Already the cultivation of the grape on a small scale has been attended to with a great measure of success. The high standard of excellence attained by Western Australian grapes and wine has given rise to a healthy demand for the latter, but there is still room for great expansion in the industry.

Wine production in this State from 1923 vintage was 232,347 gallons, valued at £46,469. Wines imported into this State for 1924 equal 155,192 gallons, valued at £76,795, which points to the market of the product being unlimited.

The exhibit of wine displayed at the Show was the product from various centres of the State, and was submitted by the leading vignerons, including the following:—Reserve Ports and Invalid Port, Rich Port, Muscat, Sherry, Claret, Hock, Frontignac Constantia, Chablis, and Altar wines. Those wines, with their health-giving properties and grown on suitable lands with a perfect sunshine, should find a foremost market here and elsewhere.

The display put up by the poultry expert of the Department had a high attraction for poultry-keepers. It covered the whole field, and those interested certainly got many useful hints from it. Included were boxes of eggs, packed for cold storage, and diagrams which showed the value of eggs and egg products.

The wool exhibit was most complete. There were many fleeces and samples; the latter included those that realised 40d. per lb. at the sales in January of this year. The photographs, which included the best types of wool-producing sheep, added materially to the value of the display. A diagram in detail showed a modern sheep dip.

The dairy exhibit was designed to reiterate the dairy expert's slogan for improving the herds of the State, viz., "Breed, Feed, and Weed." The central portion of the exhibit was occupied by a refrigerator, in which was displayed butter from every factory in the State. Over the refrigerator was an outstanding arch 11 feet high, built to represent the porch-way or entrance of a building. On the stones of the arch were depicted the various factors essential to profitable dairy farming, the keystone of which was herd-testing. A strong argument in favour of using better bulls and better methods of feeding was depicted in a series of diagrams, which showed that whereas our fine bred cattle compared with some of the world's best, our average cow did not earn her keep. The butter produced by this average cow and that of the average cow in the herd test was shown in boxes for comparison. A feature was made of the eradication of the scrub bull, using the slogan

Department of Agriculture Pavilion, 1924. Dairying and Wool Exhibits.

"Blood and feed must tell," and forcing it home by a portrait of that magnificent Australian cow and world champion butter-producer Melba XV. of Darbalara. Actual sods were shown for top-dressing experiments that had been carried out in the South-West, and the relative merits of super. and basic slag were compared. A strong point was made of the need for lime in cattle, by an exhibit which showed the methods of supplying and the dose to be given. Excellent samples of green stuff of all kinds—oats, wheat, maize, and peas—all suitable for silage, were shown.

The capabilities of the North-West were shown by small displays of cotton, cotton lint, seed, and cocoanuts.

In an attractive setting the farmer was adjured to rabbit-proof his fences, and there were on show tins of poison of sorts and also an apparatus for fumigating by a method in which cyanide played a lethal part.

The Government Botanist and Patholist, for the information of farmers, showed mounted specimens of poison plants and noxious weeds; mounted specimens of common diseases of cereals; living specimens of wheat showing flag smut, a very important disease, which has become established in the wheat belt and must be carefully guarded against. This is probably the mose serious wheat disease in the Eastern States. Attention was drawn to the need of good seed. Good crops cannot be expected from poor seed. Two samples of rape seed, similar in appearance, were shown, one of which had a germination nearly three times that of the other. A large number of clovers in pots were exhibited in the hall, including a late variety of subterranean clover. An important parasitic dodder was shown growing on subterranean clover. Clover burr from dodder-affected paddocks should be avoided.

The potato expert made a feature of the keeping qualities of Western Australian potatoes, samples of which were shown, having been kept without any special treatment for six months. Samples from different districts indicated that Western Australian potatoes keep as well as tubers in any other State. Attenion of growers was directed to the losses caused by potato moth, commonly called "the fly," by a sign which stated that "Moaning won't eradicate potato moth," and the night-light trap demonstrated one efficient method of reducing its depredations. The certified potato seed scheme was brought to notice, and the materials used were displayed.

The entomological exhibit consisted of many thousands of insect specimens, arranged in their various orders and families. There were some 25 cases of insects especially arranged under the headings of the specific plants or fruits which they attack. There were also a number of cases in which were placed the various beneficial insects. In the forestry section there were examples of the timber, showing the typical borings made by the timber-destroying insects. A large collection of gills and scales was also shown. The exhibit was topped off with a beautiful display of butterflies. The whole display gave evidence of much work and thought. There was also a working exhibit of the fig wasp, the essential insect in the cross-pollination of the Smyrna and Capri figs. The establishment of this beneficial insect in the West opens up the way to a new industry.

Department of Agriculture Pavilion, 1924. Entomological and Viticultural and Fruit Displays.

STATE EXPERIMENT FARMS.

What the State is doing to help the Farmer.

The State Exepriment Farms at Merredin and Chapman form an integral part of the "helping hand" policy of the Department of Agriculture. At these farms no labour has been spared to secure accuracy in results, and every effort has been made to render these results authoritative in character. In the early stages the farming community displayed but limited enthusiasm in the State's experiment farms, but the nature of the experiments undertaken and the educational standard of the work actually accomplished was in due time recognised by the farmers, and now the "field days" at the respective farms are red-letter days, not only in the immediate neighbourhood but attract visitors from an area many miles in radius. Each season is witnessing increasing attendances on the field days, and not only that, but on each field day those visiting are paying closer and closer attention to the object lessons prepared for them. The State experiment farm, in fact, has become a kind of post graduate school of agriculture, and that is the position it holds to-day among the farming community. At the field day at Merredin on the 17th October last over a thousand visitors attended, and although the weather was not ideal during part of the day it interfered but slightly with the interest exhibited by those who had gone to see and learn. The visitors came not only from the surrounding district, but from as far North-West as Dowerin and as far South as Narrogin, and there was also a goodly representation from Perth, including the Hon. M. F. Troy, Minister for Agriculture, the Hons. V. Hamersley and Yelland, Ms.L.C.; H. Griffiths, J. Lindsay, R. S. Sampson, H. Mann, E. H. Angelo, A. Coverley, and H. Millington, Ms.L.A. Mr. Troy, in the course of his speech welcoming the visitors, said that the agricultural industry in Western Australia was under a heavy debt of obligation to the experiment farms of the State, and the attendance that day was gratifying proof that the farmers not only recognised but keenly appreciated the work that was being done under the auspices of the Department of Agriculture.

The notes hereunder prepared under the supervision of the Director of Agriculture summarise the results of the season's activities at Merredin.

DESCRIPTIVE AND TECHNICAL NOTES.

Gerald L. Throssell, Dpl. Agric., Department of Agriculture.

The following is a summary of the acreage being cropped at the Merredin State Experiment Farm this season:—

Wheat	290	acres
Oats	98	„
Rye	8	„
Experiments	83	„
Buffers (being sections planted between each experiment and cut for hay)	21	„
Total area under crop	500	„ all on fallow.

This year the fallow totals 490 acres, and has been cultivated once with a disc cultivator and is very clean and free of weeds.

There are approximately 700 sheep being pastured on the farm, and they are largely responsible for the cleanliness of the fallow.

The Rainfall.—The average rainfall for the past 13 years has been 11.93 inches, of which 9.77 falls between the months of May and October, the growing period.

The following is the record of this year's rainfall with the monthly 13-year average in parentheses: January, 0 (51); February, 38 (50); March, 70 (80); April, 46 (86); May, 177 (129); June, 200 (172); July, 94 (195); August, 179 (147); September, 89 (92); October, 86 to date (79). Total useful rain—8.40 (9.77).

The months of January, February, March, April, July, and September are all below average; especially July, which is the driest on record since 1913.

Merredin Experimental Farm—Field Day, 17th October, 1924.
The Director of Agriculture addressing the visitors prior to inspecting the Test Rows.

The objects of the farm are

1. Improvement of cultural methods.

2. Improvement of existing wheat and oat varieties by selection and pure line breeding.

3. The production of better varieties by cross-breeding followed by selection.

4. The testing of new varieties imported from other States of the Commonwealth and the outside world. Discouraging or recommending their growth as the case may be, thus saving the farmer time and expense in testing them himself.

5. The identification of wheats. Discovering synonymous varieties, many of which are old wheats under a new name which appeals to the farmer, who is ever ready to change his seed, and often pays high prices for a so-called new variety.

6. Discovering the best methods of combating smuts.

7. The production of pedigreed graded seed.

Experiments.—The experiments on the farm can be divided into two main sections:—

(a) Those in the Test Rows.

(b) Those in the Field.

Merredin Experimental Farm—Field Day, 17th October, 1924.
The Pure Line Breeding Section of the Test Rows.

A.—Test Rows.

The area in the section described is 4¾ acres, comprising 2,458 rows, which if placed on end would reach 23 miles. Each row is one chain long and contains 100 seeds. All of these rows are planted by hand. The test rows are worked on a definite rotation:—Fallow (wheat, oats) (leguminuos crop or rape).

Test rows are divided into wheat, oat, and barley sections.

Wheat—Identification and Variety.—These rows contain 270 varieties of wheat, and are sown according to their maturity:—Very late, late, mid-season, early, and very early, facilitating observation and comparison with other varieties under test. It is here also that the identification of a variety takes place. Every variety is duplicated and its yield compared against control,

which is Gluyas Early. If any variety shows promise it is selected for seed, and tested under field conditions. At the present time two plants are selected from each row and set aside for seed for next year. By a means of classification which has been evolved by the Department, varieties are grouped together according to their similarity, this making comparison very easy. Once a variety is placed in the identification row it is not discarded, thus being of educational value.

The Pure Line Breeding Section, which occupies about half of the test rows, is where the seed which produces the farmers' seed is originated.

These stud plots contain the following varieties:—Nabawa, Gluyas Early, Merredin, Federation, Florence, and Gluyas Late.

The seed which is required to plant the Junior Field Trial is also produced in the Pure Line Section, and comprises 40 varieties.

Smut Section.—In this division many of the varieties grown in the test row is tested for its resistance to Ball Smut, being compared with the variety Booran, which is the most susceptible of any wheat grown on the farm. The wheats are infected very heavily with smut spores, and planted in chain rows, 100 seeds to the row, every fifth row being a check or Booran. The whole planting is triplicated to reduce experimental error. Towards maturity, when the infection is most marked, all plants which show signs of smut are cut out, and the percentage of smutted plants obtained compared with Booran. Some of the varieties have been found to resist smut so well as to be called "smut free," *e.g.*, Florence and Carrabin, whilst other varieties such as Sailor's Fortune and Queen's Jubilee are very susceptible.

Alongside this section is the *Fungicide Experiment*, where the best methods of prevention of smut are being determined. The wet methods of pickling have been entirely abandoned on account of the vast superiority of the dry treatment. The variety used in this experiment is entirely Booran.

The *grain is infected with* 1 *part smut to* 750 *of wheat* (which is worse than any farmer's seed would be), and treated in the following ways:—

1. Infected and untreated (check).

2. Infected and treated with copper carbonate, 2 ounces to the bushel.

3. Infected and treated with copper carbonate, 2 ounces to the bushel and re-infected.

4. Infected and treated with copper carbonate, 2 ounces to the bushel, and lime 1 ounce to the bushel.

5. Infected and treated with copper carbonate, 4 ounces to the bushel, and lime 1 ounce to the bushel.

6. Infected and treated with dehydrated copper sulphate (bluestone), 2 ounces to the bushel.

7. Infected and treated with dehydrated copper sulphate and carbonate of lime, 3 ounces to the bushel.

8. Infected with twice as much smut—2 parts to 750— and treated with copper carbonate, 2 ounces to the bushel.

Every fifth plot is a check of infected and untreated.

As before, towards maturity, smutted plants are cut out and the percentage smutted calculated.

On Field Day only the first four plots had been cut. The infected and untreated row contained about 90 per cent. smutted plants, while in the adjacent row (infected and treated, 2 ounces to the bushel copper carbonate) only 2 per cent. smutted plants was obtained.

The infected dehydrated bluestone treatment appeared to be giving as good results as the copper carbonate, while the use of lime, on appearance, did not seem to be of any benefit.

The next section is that set aside for *Cross-breeding*, which comprises about ½ an acre. Here there are a large number of cross-breds, many of which are in their second generation, on which it is too early for any comment. These crossbreds are all grown under smut; that is, after the first generation the seed is always infected with smut, and only plants free of smut are selected. In this way smut escaping and resisting varieties are obtained. Any cross which is smut liable is rejected.

Merredin Experimental Farm—Field Day, 17th October, 1924.
The Identification Section of the Test Rows.

Six named cross-breds have been produced from this farm, namely:—Merredin (Federation X Gluyas Early), Carrabin (Cedar X Florence), Nangeenan (Federation X Huguenot), Nungarin (Federation X Cedar), Booran (Federation X Volga Barley), Belka (Federation X Cedar).

When a cross is fixed it is given a number, and then grown in the identification and smut resistance rows, and if it should show any promise it is tested in the field.

New cross-breds at present being tested in the field are:—

Merredin No. 15.—(Sunset X Gluyas Early), a very early maturing, short-strawed, free stooling variety.

Merredin No. 14.—(Nabawa X Bunyip), a variety earlier than, but possessing many of the characteristics of Nabawa).

Merredin No. 9.—(Bunyip X Huguenot), a short-strawed, very smut-resistant, early, high-yielding wheat of considerable promise.

Merredin No. 2.—(Thew X Federation), a short-strawed early variety, which should be better than Federation.

This is the first time these crosses have been tested under field conditions. They are planted in plots ⅛th of an acre each.

Oats.—In the oat section of the test rows there are 50 varieties to be found. Sowing and testing is practically identical with that of the wheat plots, except that there is no smut-resistant test.

Pure Line Breeding.—There are seven varieties of oats grown in this section for stud seed purposes.

Merredin Experimental Farm—Field Day, 17th October, 1924.
Visitors examining the Test Rows.

Barley. Identification and variety test rows: There are 30 varieties of barley grown in this section.

All this work in connection with the test rows is under the control of Mr. Limbourn, who devotes the whole of his time to it.

The Grass Garden.—The small enclosure near the quarters, which contain the meteorological observation instruments, is called the grass garden.

This year the brightly-coloured flowers cannot escape the eye. The history of the German agricultural development during the last three centuries centres around the *Lupin,* which converted a sandy waste into a fertile country-side. Alive to the value of the lupin, the Department has imported from Germany about 40 different varieties of lupins in an endeavour to get better results than the local Blue (*Lupinus augustifolius*), Yellow (*Lupinus luteus*), and White (*Lupinus alba*) varieties. So far many of the imported lupines are showing distinct superiority over the blue local variety, which has made very poor growth.

A fine stand of lucerne, which had no irrigation whatsoever, was growing in the garden. At this stage it was about 2ft. high, and did not appear to be suffering from the weather. It is clearly shown that once the lucerne has become established with intercultivation, it should produce a profitable crop when grown for fodder.

Selected varieties of field peas, horse beans, vetches, cowpeas, and lentils are also growing in the garden, and altogether they make an interesting departure from what one would expect to find on a wheat farm.

Merredin Experimental Farm—Field Day, 17th October, 1924.
Wheat.

Bulk Cropping.

There are five varieties of stud wheats, as follow:—Nabawa, 4 acres; Gluyas Early, 4 acres; Merredin, 2 acres; Federation, 1 acre; Carrabin, 1 acre; total, 12 acres.

The seed from these varieties is used for experiments and bulk seed crops the following year, which furnish the farmers' seed. The rate of seed-

ing varies up to 30 pounds, according to the quantity available. The rate of super is 84 pounds. All the stud seed plots are looking extremely well, and the manager estimates a high average.

The Bulk Seed Crop contains the following varieties:—Nabawa, 111 acres; Gluyas Early, 60 acres; Merredin, 80 acres; Federation, 14 acres; Florence, 12 acres; total, 277 acres.

The rate of seeding with the bulk cropping is 45lbs. seed and 84lbs. super. per acre. These crops are all sown in May, and on fallow.

Pickling for Smut.—All the seed sown on the farm, except in the case of the smut and fungicide tests, was pickled with copper carbonate at the rate of 2ozs. to the bushel. The pickler is a small box, which was made on the farm, and gives very satisfactory results, for there is no smut in the crop at all this year.

Last season 2,025 graded 3-bushel bags of pedigreed wheat and 660 bags of oats were produced. The wheat so produced at Merredin would, if sown as the Department recommends at 45lbs. to the acre, be sufficient to sow an area of 8,100 acres this year.

The average yields, exclusive of fodder crops and test rows, of the 1923 croppings were as follow:—

	acres.	bus.	lbs.
Wheat:—			
Fallowed	210·89	27	2
Not fallowed	39·52	18	43
Difference per acre in favour of fallowing ...	...	8	19

	acres.	bus.	lbs.
Oats:—			
Fallowed	59·61	36	0

	acres.	cwts.
Hay:—		
Fallowed	89·48	40

There are three main varieties of oats grown in stud: Guyra, 2 acres; Burt's Early, 2 acres; Lachlan, 2 acres; other varieties, 3 acres; total 9 acres.

The average yield per acre for stud oats last year was 29.9 bushels.

Bulk Oat Crops.—Guyra, 34 acres; Burt's Early, 15 acres; Lachlan, 20 acres; total 69 acres.

Oats are sown at the rate of one bushel to the acre with 84lbs. of super.

Rotation.—The paddock where the bulk crops and experiments are this year was under crop in 1921, stubble in 1922, fallow in 1923.

When previously cropped this paddock was absolutely infested with wild oats, but this rotation and the use of sheep, together with judicious and early cultivation of the fallow, has reduced the presence of the oats so as to be hardly noticeable. This is the case in all the paddocks, particularly so in the rotation experiment, where one plot is sown with wheat continuously year after year and is very badly infested with oats, while the adjacent plot, on

which fallow follows, wheat is very much freer from them as well as deriving benefit from fallowing, as the following average yields, 1916-1921, of the two plots, indicate:—

	Hay Yield.			Grain Yield.	
	cwts.	qrs.	lbs.	bus.	lbs.
Continuous wheat after fallow	41	2	26	22	43
Continuous wheat without fallow	24	3	1	10	47
Increase in favour of fallowing	16	3	25	11	56

The rest of the rotation experiment has been fed off by sheep, because of its being re-modelled on different lines.

Merredin Experimental Farm—Field Day, 17th October, 1924.
Examining the rotation experiments.

B.—Field Experiments.

Experiments.—The main objects of the experiments are to determine—

(a) When to fallow.
(b) How deep to plough.
(c) What cultivation of the fallowed land is necessary.
(d) When to sow.
(e) How late to sow.
(f) What rates of seed and super. are the best, and
(g) Which are the best varieties of wheat to sow, and when.

These experiments are arranged in a definite sequence facing the railway line. The fallow on which all crops are sown was ploughed in May and June, 1923, cultivated in the spring, once in February after the rain, and again prior to seeding.

Merredin Experimental Farm—Field Day, 17th October, 1924.
Rotation Experiment: Wheat after Fallow—showing absence of weeds and wild oats.

The area of the experiments is:—

	acres.
Wheat Variety Trial	23
Oat Variety Trial	10
Fertiliser Experiment	3·5
Seeding Experiment	10·5
Seasonal Planting	5·0
Late Seeding	2·0
Mulching Experiment	3·0
Ploughing Experiment	3
Wimmera (or late fallowing)	2
Rotation	13
Test Rows	7·5
Total	82·5

The length of all the plots is 10 chains, so arranged that one drill width equals 1/8th acre, which very greatly assists the laying out.

Unless where otherwise stated the rates of seeding and super. remain constant, that is, 45lbs. seed and 84lbs. super.

First experiment—time of fallowing—is based on Wimmera methods.

One plot, ½ an acre in extent (that is four drill widths), was ploughed 4in. deep in May, while the next plot—separated by a buffer—was ploughed 4in. deep in August and cultivated in spring, and treated in the same manner as the main crop. The variety of the seed used was Nabawa. The early fallowing showed a decided advantage over the late, being greener in colour, stronger in growth, and much freer of wild oats. This is the first time this experiment has been carried out. One drill width is cut for hay and three drill widths are left for grain.

Merredin Experimental Farm—Field Day, 17th October, 1924.
Rotation Experiment: Wheat continuously encourages wild oats.

Second experiment—best depth to plough.—There are three plots.

The first plot was ploughed 4in. deep, the second 6in., and the third 8in. in May, 1923, and sown with Gluyas Early in May, 1924. On appearance they are very similar, except that the 8in. shows more growth and is slightly greener.

The average yields for nine years, 1915 to 1923, are:—

Ploughed.	Hay Yield.				Grain Yield.		
	cwt.	qr.	lbs.	%	bus.	lbs.	%
4 inches	50	0	24	106	23	33	103
6 inches	47	1	4	100	22	56	100
8 inches	50	0	0	106	23	9	101

Third experiment—mulching.—In the Wimmera the leading farmers cultivate their fallow as many as 17 times after the rain. This experiment is to determine whether this system is profitable under our conditions.

There are three plots, each ½ acre in extent, all of which were fallowed 4in. deep in May, 1923. The first was cultivated in the spring, after the rain during the summer, and prior to seeding in mid-May, 1924. The second plot was mulched in the spring, and only before seeding. The third plot was neglected fallow, only being cultivated prior to seeding, and sown with Nabawa—45lbs. seed, 84lbs. super. Taken over an average of eight years, the Wimmera methods are not profitable under our conditions; the plot which was cultivated in the spring, again before seeding, giving the best returns.

The neglected fallow was very dirty with weeds and wild oats, and had not the strong green colour which the other plots displayed, showing that the conserving of the moisture also stimulates the production of nitrates.

Mulching Experiment—Eight years' average—1916-1923.

Treatment.	Hay Yield.				Grain Yield.		
	cwt.	qrs.	lbs.	%	bus.	lbs.	%
Mulched in Spring after rain, during summer, and before planting	51	2	8	103	22	51	101
Mulched in Spring and before planting only	49	3	21	100	22	43	100
Neglected fallow, cultivated before seeding only	49	3	15	100	21	17	94

Fourth experiment—late seeding. There are three plots, each ⅛th acre, repeated three times to determine the best time to sow an early variety.

The first plot was sown on 17th May. The second plot was sown on 17th June, and the third plot was sown on 14th July. The May sown crop is very fine indeed, and will probably yield 24 bushels, standing about 4ft. high. The June plot suffered from the dry spell, and is only about 3ft. high, and it will probably yield about 75 per cent. of the May sown. The July sown plots are only about 18in. high, the ear being caught in the flag, and will probably yield only about 50 per cent. of the May sown crop. This is, perhaps, the most instructive experiment of all, no doubt accounting for so many poor crops in the Eastern Wheat Belt this season.

The following is the yield for 1923:—

Date of Seeding.	Average Yield per acre.		%
	bus.	lbs.	
May 14th	34	13	100
June 13th	27	33	81
July 16th	15	47	46

Fifth experiment—rate of seeding.—The variety Nabawa was used in identical plots to previous experiment at rates of 30, 45, and 60 lbs. per acre with 84 lbs. super., and sown in mid-May.

The new system of experimentation has been instituted in this experiment, whereby each plot of 1/8th acre is repeated eight times—making 24 plots in all, not counting buffers. Five plots of each respective seeding are reserved for grain, while three of each are cut for hay. The appearances favour the light sowing which has stooled out very well, while in the heavier sowings there is a tendency to lodge.

A similar experiment with the same variety and number of plots was conducted with the rates of 45, 60, and 90 lbs. per acre to determine the advantage of a heavier sowing.

The average yields for 10 years are as shown hereunder:—

MID-SEASON VARIETY.—NABAWA.

Rate of Seed per acre	Hay Yield.				Grain Yield.		
	cwt.	qrs.	lbs.	%	bus.	lbs.	%
30lbs.	42	2	24	94	19	55	95
45lbs.	46	2	8	100	21	4	100
60lbs.	46	3	12	101	20	40	98

EARLY VARIETY.—FLORENCE.

Rate of Seed per acre.	Hay Yield.				Grain Yield.		
	cwt.	qrs.	lbs.	%	bus.	lbs.	%
30lbs.	44	3	4	96	20	43	98
45lbs.	46	2	24	100	21	12	100
60lbs.	44	1	20	95	21	7	100

Sixth experiment—rate of superphosphate.—This is to determine the most profitable rate per acre.

Three rates were used, 75, 150, and 225 lbs. per acre, and the variety planted was Gluyas Early at the rate of 45lbs. seed per acre.

The new system of experimentation was used for this test also—each plot being 1/8th acre, and repeated eight times. Five plots were reserved for grain and three cut for hay. All these plots are growing a magnificent crop, the most noticeable feature being that the heavier application of super. is hastening maturity, but after the rain the heaviest plot showed a tendency to lodge.

This is the second year this experiment has been conducted, the following being the results for 1923:—

	Hay.						Grain.					
	75lbs.			150lbs.			225lbs.			75lbs.	150lbs.	225lbs.
	cwt.	qr.	lbs.	cwt.	qr.	lbs.	cwt.	qr.	lbs.	bus. lbs.	bus. lbs.	bus. lbs.
Average yield per acre	54	2	5	56	2	7	57	0	11	31 4	34 43	35 18
Increase due to higher rate of fertiliser ...	...			2	0	12	2	2	6	...	3 39	4 14

Seventh experiment seasonal planting. This experiment was previously conducted in the test rows, but on account of inter-cultivation for weeds and the destruction wrought by parrots, no reliable information was obtained.

The four standard varieties—Yandilla King (late), Nabawa (mid-season), Gluyas Early, and Florence (very early)—were planted in April and June, with check plots of Gluyas Early planted in May—all repeated three times.

Results will be obtained which will contradict the results previously obtained in the test rows, and should be of great value.

Merredin Experimental Farm—Field Day, 17th October, 1924.
Oats.

Junior Field Trial. Contradictory results were also obtained in the test rows with the triplicate tests, where the yields of varieties were compared against Gluyas Early as control, owing to inter-cultivation and the distance between the rows.

This year for the first time an altogether new system has been evolved, where 40 varieties are being tested under field conditions, sown in exactly the same way, with same rate of seeding and super., and the similar soil as the other experiments.

The distributors of the drill were filled with different varieties of wheat—commencing with the outside two distributors, which were filled with Gluyas Early as a check, then every two distributors with a different variety, making five varieties to one drill width with two rows of Gluyas Early on each side. The wheats were kept carefully separate, and whilst one man drove the drill another kept the distributors filled with their respective varieties. There are

eight drill widths in this experiment, which extends for 10 chains. Through the length of the plots they are divided into chain sections by a path two links wide across the plot. Three sections are cut for hay and five for grain, these being threshed by means of a small power thresher.

The result of this experiment will be absolutely reliable; experimental error being reduced to a negligible factor owing to repetition.

Rate of seeding was 45lbs. seed, 84lbs. super. per acre, sown in mid-May.

Field Variety Trial.—On a larger scale the most promising varieties are tested. There are 17 varieties of wheat, namely:—Gluyas Early, Yandilla King, Gluyas Late, Wannon, Federation, Hard Federation, Gallipoli, Nabawa, Gresley, Nungarin, Nangeenan, Nizam, Belka, Carrabin, Canberra, Merredin, and Florence, and between each five there is a plot of Gluyas Early as a check. These plots are repeated eight times, five being reserved for grain and three cut for hay. This experiment alone covers 23 acres, and experimental error here is also a negligible factor. Nowhere in Australia is such a thorough system of experimentation conducted, and these systems have been entirely evolved at the Chapman and Merredin Experiment Farms.

On similar lines an *Oat Variety Trial* is conducted, namely:—Burt's Early (as check), Mulga, Lachlan, Ruakura, Algerian, Wilga, and Guyra. Between every five, as before, Burt's Early oats are sown as a check. This experiment is repeated eight times, five plots being reserved for grain and three cut for hay, while the rate of seeding is one bushel per acre.

The whole of the work on the farm entails a large amount of careful preparation, and the increasing attendances at each succeeding field day is surely a reward for all the work that is being done.

SHEEP BRANDING.

A Soluble Marking Fluid.

Cabled reports of the recent conference at Broadford, England, between Empire wool-growers and representatives of the wool trades indicate that much interest was focussed on the question of the branding of sheep. It was pointed out that the presence of tar in Australian wool, due to tar branding of sheep, has a serious effect on the value of our wool. Wool-growers were urged to use a marking fluid which would wash out in the scour and thus overcome this difficulty.

Such a marking fluid has already been available to pastoralists in Australia and New Zealand for a number of years. The Vacuum Oil Company Proprietary, Limited, after considerable research, produced a sheep-marking fluid, "Vacmark," which is being used extensively with excellent results, and is gaining in popularity as more and more pastoralists realise its advantages. This fluid does not contain any tar, tar oil, or any other product which will spoil the fleece. The use of a marking fluid which is guaranteed to meet the conditions demanded by the manufacturers will well repay the wool grower.

THE DEVELOPMENT OF A DAIRY HERD.

(*Continued.*)

P. G. Hampshire,
Dairy Expert.

"MANAGEMENT."

In previous articles "selection," "breeding," "feeding" have been dealt with, and we now come to "management." To secure the best results from a good herd of well fed cows considerable attention must be paid to them in regard to handling and management. Heavy producing profitable dairy cows are, as a rule, high strung animals which require very often individual treatment, and patience and gentleness play a big part in inducing cows to give of their best. A dairy farmer is well rewarded for the painstaking care and attention he gives his herd.

Ideal Dairy Herd Conditions.

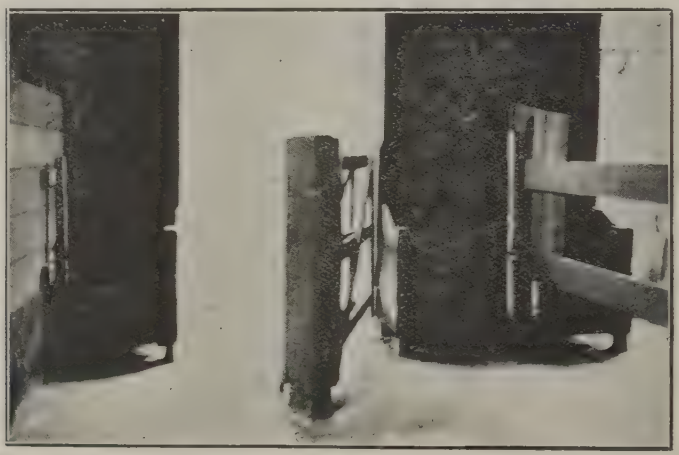
This article is written more especially for the large number of settlers in Western Australia embarking in dairying, many of whom have had little experience with cattle, and who, no doubt, will welcome advice in regard to handling and feeding the animals, which will be a work of interest and ultimate independence. The rough hand, harsh voice, and careless treatment of dairy cows result in nervousness and development of vicious habits, such as kicking, fence-jumping and breaking, and greatly reduced milk flow. Practice always—even when things appear to go contrary—the soft voice and gentle hand with the dairy cow. Generally the cow is much more frightened of you than even you sometimes may be of her. A

kind voice and gentle hand will do a lot to dissipate her strangeness and timidness. What a fine thing it is to see the cows of the herd come up to their owner in the field to be petted. Although it takes a minute or two, it well repays the dairy farmer to groom his cows daily—it is like a wash; it cleans their coats and accustoms them to be handled, and is one of the best means of breaking down timidity and fractiousness.

Milking.

When bringing cows up to be milked they should not be rushed or unduly excited—teach the herd to come when called. Dogs are not desirable on dairy farms, as the sight of dogs will often upset newly calved cows and excite the whole herd. Dogs that chase cows should be immediately got rid of.

In the case of fairly big herds an outer or large yard of sufficient size to prevent cramping should be used to assemble the herd for milking, and batches should be drafted into the inner or smaller yard and from there to the bails. The "walk through" type of bail is without doubt the best to build, as it avoids mixing the milked cows with those waiting to be milked; there is no backing and slipping down, often with serious results, and the cows when milked are enabled to go straight out to the pastures singly at their leisure, with the advantage of no congestion and often as much as two or three more hours in the field per day. For full information in regard to



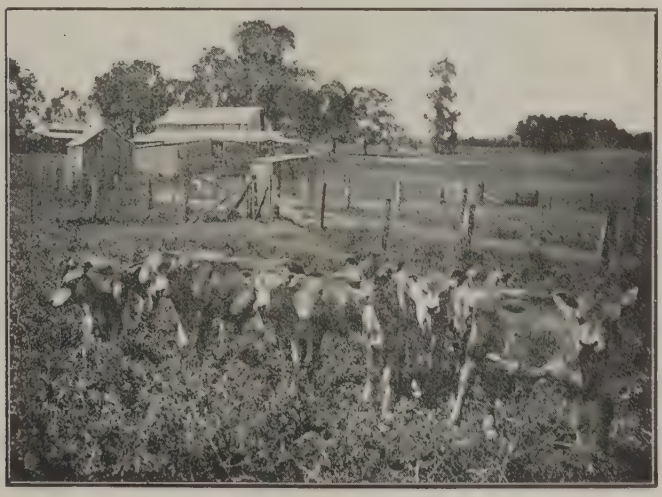
The Walk-through Type of Bail.

the erection of various types of bails and yards, etc., obtain Bulletin No. 91, "Dairy Premises." After bailing up the cow the first thing to do is to wash her udder. The few seconds occupied in carrying out this very desirable hygienic measure is gained by the fact that it induces the cow to "let down" her milk ready for the milker. The operation of milking should be carried out as quickly as possible. Do not stop during milking and leave the cow, and be certain the whole of the milk is "stripped" out of the udder before leaving the cow as finished. If any milk is left in the cow's udder she will

give that much less the next milking. The last milk contains the most butter fat, and the last quart of milk given by the cow will contain on an average five times as much fat as the first quart. As a precaution against the continuance of unsuspected udder troubles, the first stream of milk from each teat should be examined for any signs of curd, thick milk, or discoloration of the milk.

Rearing Calves.

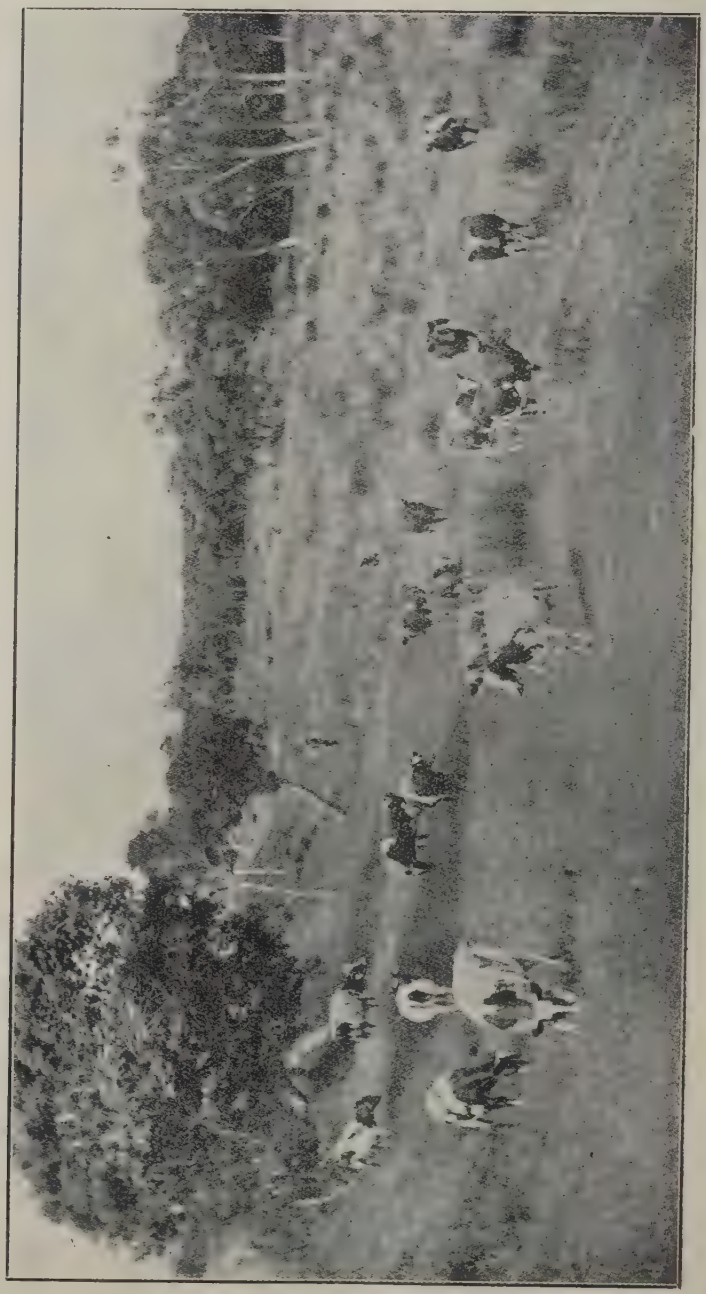
In rearing calves it is advisable to allow the calf to remain with the cow from one to three days, and even longer in the case of heifers. The calf should then be taken out of sight, and, if possible, out of hearing of the cow, and placed in a special calf paddock or tied up separately near other young calves, with provision for shade in the summer and shelter in the winter. For the first week the calf should be given its own mother's milk; this is very necessary for the calf, and the cow's milk, as a rule, will not be fit for commercial use. For the next three weeks the calf should receive a mixture of whole milk and skim milk, with the former gradually reduced



Calves Reared under Good Conditions.

to nil and by the gradual addition of a calf food to take the place of the whole milk. After one month the calf should be fed on skim milk with the addition of the specially prepared calf food in quantities as directed by the makers. This should be supplemented by crushed oats, bran, lucerne, or clover hay in troughs, which they may have access to in their paddock and always apart from the herd of grown stock. Access to pasture is of great value to induce early feeding and keep the bowels in good condition.

The principal cause of miserable weedy calves and mortality in calves is scours. Scours is a trouble hard to cure—prevention is best. The four main causes of scours in calves are: irregular feeding hours, irregular feed-



An Ayrshire Herd.

ing temperatures, unclean vessels or surroundings, and sudden changes in foods. Prevention of the trouble is by feeding at regular hours, feeding milk at blood heat, viz., 98deg., using thoroughly clean troughs or buckets, and by not making sudden changes in food. On the first indication of diarrhœa, the calf's food should be reduced and a small quantity of lime water mixed with the milk. In a severe case 15 drops of tincture of opium will be found effective, but remember prevention is the best cure. Isolate all affected calves, as the trouble is infectious.

To prevent calves sucking one another, often to the detriment of the future cows' udders, small bails will be of distinct advantage, calves will be easier to handle, and there will be no spilt milk, no bad tempers, and, if left in their miniature bails for half an hour after feeding, where they can be fed with concentrates, the inclination to suck goes off. Calves should be weaned off milk at four to six months. Foods rich in protein such as lucerne, clover hay, bran, crushed oats, are necessary for growing heifers; avoid fat-forming foods. It is necessary to build up strong frames, bone, muscle and tissue in the growing heifers. Keep the young stock apart from the herd.

Pasturing the Herd.

The ideal conditions to obtain the best results from a dairy farm are small mixed pasture paddocks and frequent changes. In this way, over a much longer period a fresh bite of succulent pasture is provided—paddocks shut up have an opportunity to recuperate. When the herd is taken out of a paddock, run the harrows over the field upside down to break up the manure heaps, as this enables the manure to work down among the roots of the grass and avoids sour patches.

Do not allow young stock or dry cows with the milking cows; give the latter the best pasture always. On no account allow horses in the same pasture as the herd of milking cows, as horses can eat much closer to the ground than cattle. Provide trees for shade in the summer and shelter in the winter, and always have a liberal supply of good water easily obtainable for the milking cows. A plentiful supply of good water is essential to the milking cows—remember that cow's milk contains 87 per cent. water.

Change of Feeds.

The dairyman should avoid, as far as possible, any sudden change in the feeding of his herd –all changes should be gradual. A variety of foods is good, but do not introduce a new main food in the ration suddenly. Note results with all changes of feeding, and, if increased production is observed, go on increasing the feed if the increased production shows a profit.

Strong-flavoured Feed.

It is inadvisable to feed strong pungent flavoured feed to cows during milking, or just prior to milking. Where it is necessary to use such feeds, the herd should be fed immediately after milking and taken away from this foodstuff, say, four hours prior to milking time. Most food flavours are very volatile and will have passed out of the animal's system if sufficient time is allowed. Quite a number of weeds, and even clovers and lucerne, impart an unpleasant taste and aroma to milk if cows graze such feed right up to milking time. In cases of highly flavoured milk, æration immediately it leaves the cow considerably improves the milk by assisting undesirable flavours to escape.

A Good Line of Holstein Heifers.

Mating Heifers.

There is a variation of opinion regarding the proper time to breed heifers. As a general rule it is advisable to mate heifers early if they are well grown. Most dairymen find they obtain best results by "calving down" heifers at two years. If, on the other hand, the heifers are on the small side or have been stunted in their growth through lack of suitable feed while they are growing, or other causes, it may be advisable not to mate these heifers to calve earlier than 2½ years. It is not desirable to allow dairy heifers to go over 2½ years before they are bred, as there is a likelihood of their proving barren. Do not use a clumsy heavy bull with heifers.

Dairy farmers are well advised to feed growing heifers well with nitrogenous foods—foods that will build big frames. Do not expect heifers to do well on rough bush feed; it pays handsomely to have them big and growthy with no checks in their development. Feed heifers well with good succulent feed when they begin to spring; this is very important, as it is during this stage the heifer is making an udder, and, if neglected during this stage, the capacity of her milk vessel will suffer.

The First Lactation Period.

It is most important that heifers on first calf should be handled well and fed well, and especially it is urged that they be milked as long as possible—when we say long we mean at least ten months and, preferably, twelve months. Even if the young cows are only giving a small quantity of milk, keep them going—to "dry off" at, say, five months is fatal, as with each subsequent lactation they will tend to "dry off" at a similar time; keep heifers going as it induces milk "staying" power.

Most breeders find it best to breed heifers early, milk for twelve months on first calf, and keep them away from the bull for four or five months after calving, allowing them to finish growing between the first and second calf.

Careful handling on first calf generally avoids all future trouble. Careless rough handling of heifers makes nervous or bad tempered cows. Keep a record of the heifer's production by having her tested, as a heifer's test is her life's test. She will not materially improve in the percentage of fat in after life, provided that, when the test was taken, she was in normal health and sufficiently fed. All increase in fat production will come from increased quantity of milk. Do not condemn a heifer on first calf that is disappointing in the quantity of milk, provided she "milks" for, say, ten months or more. Many young cows improve greatly on subsequent calvings, but if heifers "dry off" quickly they are not, as a rule, worth persevering with.

"Drying Off."

It is advisable to give cows from a month to six weeks' spell between the end of one lactation and the commencing of the next. This spell gives them an opportunity of recuperating after the big tax on their system during the milking period. In the case of cows which fall away in condition during their lactation, it gives them an opportunity to lay on flesh and generally fit them to start off with the next "freshening" in good heart and a toned-up system. If cows are milked right up to calving their production on freshening usually suffers considerably, and such a practice continued will bring about premature aging of the animals, and low average yields. It is difficult to "dry off" some cows, usually very good ones, and great care

must be exercised to avoid udder troubles. The first matter to consider is reduction in feed, substituting dry foods for succulent foods. Milk once per day for a while, then once each alternate day, followed by a milking and two days' spell, providing, of course, the cows are not making much milk.

Care of Cows near and after Parturition.

It well repays dairymen to give cows close attention when nearing calving. In large herds a special calving paddock in the summer, and loose boxes in winter, close under the owner's eye, are an advantage. Sufficient feed of a succulent nature to keep cows in nice condition without putting on undue flesh is advised. Any evidence of hardness of dung should be rectified by a laxative such as epsom salts in a bran mash, and it is a good practice to give cows from ¾lb. to 1lb. of epsom salts a day or two prior to calving. Do not allow dogs or pigs in close proximity of cows about to calve. Do not feed cows heavily just after calving, but bring them up to their feed gradually. If the cows do not clean up normally after parturition, drench with a laxative with the addition of ground ginger or some such stimulant.

Cows subject to attacks of milk fever should be closely watched and remedial measures applied early in the attack. The Schmidt air process is 99 per cent. effective. Heifers rarely suffer from milk fever, and second calf cows are seldom attacked. Milk fever usually attacks heavy producing cows that are in high condition prior to parturition. Milk fever outfits have been supplied to all groups and should be availed of at once, for, if neglected, a cow badly affected will die in 36 to 48 hours. In all cases of difficulty in parturition or mal-presentation, veterinary advice should be obtained promptly.

Breeding to Calve at most suitable period of Year.

It is a distinct advantage to have the cows "freshening" just prior to the commencement of the season, in order that, during the bulk of the flush months of their production, pastures are at their best. Whilst this desirable practice is not always possible to manage accurately, a dairyman should set his plans to accomplish the matter as far as lays in his power. The isolation of the bull is essential, for, if the dairy sire is allowed to run with the herd, no control in regard to bringing the cows in at the desired period can be secured.

Care of the Bull.

My first recommendation to dairy farmers in the management of the dairy sire is that he be securely paddocked apart from the herd. The practice of allowing the bull to roam with the herd of cows is undesirable, from many aspects. There is always the danger of the animal attacking either employees or visitors no matter how quiet he may appear to be, and to allow a bull full run of the farm is to invite him to become a rogue and a fence breaker. A bull with a herd always means that the farmer cannot keep any reliable record of dates of service; he cannot keep cows back from the bull if he so desires, and it is not possible to regulate when the cows shall "freshen"; contagious diseases, such as the most dreaded trouble—contagious abortion, cannot be checked or stamped out, and, finally, a bull's services are needlessly wasted.

The bull is the sire of all the heifers the dairyman is rearing to build up and replenish his herd—there is 50 per cent. of his blood in every new

member of the herd, and the bull must be the son of a better cow than any in the farmer's herd if an improvement is to be expected in the heifers the farmer is breeding. Therefore, a bull should be specially cared for—he is "half the herd."

A strongly fenced paddock of from half an acre upwards should be provided and provision made for shade in the summer and shelter in the winter. A working bull should be fed well with non-fattening food; he

Some nice Jersey Heifers at D. J. Goyder's farm, Roelands Park.

must not be allowed to become fat and lazy—exercise is important, and a large loose stump is excellent for him to have a bout with. If he becomes fretful or excited, put in an old cow or two, or a few calves, to keep him company.

To readers desirous of building a "Safety Bull Paddock" I would recommend that they procure Bulletin No. 91 –"Dairy Premises," page 7, describes in detail the erection of a suitable bull paddock.

Keeping of Accounts and Production Records.

It is of considerable value to the dairy farmer to keep an account of all receipts and expenditure each year in order that he may be enabled to review the position at the end of each year's work. The keeping of such information does not require much time and may be entered in an ordinary exercise book. It is not proposed to go into details in regard to this matter in this article, as it is proposed to devote special attention to this very important subject in the next issue of the "Journal," more particularly with Testing and Culling the herd.

Unless the farmer keeps records of all ingoings and outgoings, dates of service of cows, records of births, and production of each individual member of his herd of cows, he is not in a position to satisfactorily improve his methods and ascertain how he can turn a loss into a profit. A proper record of all matters referred to on the dairy farm are the guiding reins in the management of a dairy herd.

HERD TESTING.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION SCHEME.

Conducted by Dairy Branch, Department of Agriculture, Western Australia.

Results since 1st July, 1924.

Name of Cow.	Owner.	Breed.	Herd Book No.	Age at beginning of Test.		Date of Calving.	No. of Days in Test.	Weight of Milk for Period.	Average Test.	Total Butter Fat.	Weight of Milk Last day of Test.	Remarks.
				Yrs.	Mths.			lbs.	%	lbs.		
MATURE COWS—STANDARD REQUIRED 350 LBS. OF BUTTER FAT—273 DAYS.												
Campaniles Maid of Garden Hill	R. H. Rose ...	Jersey ...	8935	10	5	11–11–23	273	9,235	5·53	511·18	30½	
Lady Fowler 4th of Dardanup	D. J. Goyder ...	do. ...	10004	7	2	20–11–23	273	7,846	5·42	425·72	23	
Wild Rose II. of Garden Hill ...	W. Padbury ...	do. ...	10091	7	2	7–10–23	273	6,534	5·77	377·03	9½	
Noreen 5th of Garden Hill ...	do.	do. ...	7125	5	4	7–10–23	273	5,713	6·07	346·96	14	
Ettie IV.	do.	do. ...	2889	13	0	4–10–23	273	7,683	4·44	341·43	15	
Cheerful II. of Yarralla ...	A. H. Henning ...	do. ...	6258	7	8	17–10–23	273	5,799	5·57	323·29	17	
Gladness of Wollongbar ...	Department of Agriculture	Guernsey...	452	5	5	25–9–23	273	5,967	4·88	291·45	16	
Lady Fowler 5th of Dardanup	D. J. Goyder ...	Jersey ...	9990	6	8	26 5–24	90	2,550	4·79	122·37	27	Withdrawn.
SENIOR 4 YEARS OLD (OVER 4½ YEARS AND UNDER 5 YEARS)—STANDARD 325 LBS. BUTTER FAT.												
Milton's Syringa	A. W. Padbury ...	Guernsey...	503	4	7	4–12–23	273	6,465	6·22	402·07	16	
Lady Fowler 7th of Dardanup	T. L. Rose... ...	Jersey ...	10006	4	11	1–11–23	273	7,188	5·11	367·73	20	
Retford Tessie	W. Padbury ...	do. ...	8464	4	6	10–10–23	183	2,952	5·53	163·28	9	
Yarraview Georgina	A. W. Padbury ...	Guernsey...	782	4	8	18–6 24	30	825	5·12	42·27	27½	Sold.
JUNIOR 4 YEARS OLD (OVER 4 YEARS AND UNDER 4½ YEARS)—STANDARD 300 LBS. OF BUTTER FAT.												
Daisy Vale of Grass Vale ...	R. H. Rose ...	Jersey ...	8474	4	2	4–2–24	273	8,143	5·71	465·45	30½	
Lady Fowler 10th of Dardanup	do.	do. ...	10009	4	2	25–12–23	273	6,297	5·12	322·62	14½	
Rocket of Wollongbar	Department of Agriculture	Guernsey...	541	4	5	14–10–23	273	6,018	4·85	291·89	12	
Gentle of Blackheath	D. Malcolm ...	M.S. ...	11679	4	2	19–11–23	273	5,269	4·15	220·25	5	
SENIOR 3 YEARS OLD (OVER 3½ YEARS AND UNDER 4 YEARS)—STANDARD 275 LBS. OF BUTTER FAT.												
Treasure III. of Homeleigh ...	D. Malcolm ...	M.S. ...	N.Y.A.	3	9	21–10–23	273	8,829	4·68	413·77	22½	
Mermaid of Blackheath ...	do.	do. ...	12156	3	11	1–12–23	273	4,745	4·09	194·20	13	

JUNIOR 3 YEARS OLD (Over 3 Years and under 3½ Years)—STANDARD 250 LBS. OF BUTTER FAT.

Lily of Grass Vale	R. H. Rose	Jersey	8497	3	4	6 1 24	273	8,772	5·03	442·87	32	
Morden Lady of Koogan	A. W. Padbury	Guernsey	722	3	1	23–9–23	273	10,296	3·78	389·41	31	
Lady Fowler 12th of Dardanup	R. H. Rose	Jersey	10011	3	2	6–2–24	273	8,065	4·81	388·15	24	
Rhodora II. of Dalebank	D. Malcolm	do.	8451	3	0	4–9–23	273	6,286	5·79	364·01	14½	
Madge II. of Dalebank	do.	do.	8449	3	3	1–12–23	273	5,180	6·36	329·80	18	
Velvet of Wollongbar	Department of Agriculture	Guernsey	774	3	5	19–10–23	273	5,703	4·25	242·79	...	
Lady Betty of Koogan	A. W. Padbury	do.	655	3	2	11–6–24	30	780	4·33	33·78	26	Sold.

SENIOR HEIFERS (Under 3 Years and over 2½ Years)—STANDARD 225 LBS. OF BUTTER FAT.

Lady Fowler 11th of Dardanup	T. L. Rose	Jersey	10010	2	11	14–12–23	273	6,996	5·76	403·42	19	
Sheila of Sarnia	D. Malcolm	do.	8452	2	11	16–10–23	273	5,392	6·21	334·99	14	
Gladness II. of Wollongbar	Department of Agriculture	Guernsey	631	2	7	27–11–23	273	4,299	5·77	248·39	12	
Junket of Koogan	A. W. Padbury	do.	654	2	9	2–3–24	150	3,148	4·91	154·78	17	Sold.

JUNIOR HEIFERS (Under 2½ Years)—STANDARD 200 LBS. OF BUTTER FAT.

Mokine Empire's Lily 7th	T. H. Wilding	Jersey	11794	2	5	14–2–24	273	6,755	5·74	388·31	23	
Wild Rose III. of Garden Hill	W. Padbury	do.	N.Y.A.	2	2	24–10–23	273	5,077	5·52	280·34	14½	
Queen of Sarnia	D. Malcolm	do.	12091	2	4	15–12–23	273	4,173	4·92	205·37	13	
Carnation III. of Greyleigh	do.	M.S.	N.Y.A.	2	0	18–1–24	273	5,600	3·49	195·51	12	
Bonnie Margaret of Koogan	A. W. Padbury	Guernsey	808	1	10	16–5–24	30	480	6·23	29·94	16	Withdrawn.

365 DAYS TEST.

Lady Fowler 14th of Dardanup	R. H. Rose	Jersey	12093	1	11	30–8–23	365	9,365	5·57	521·86	20½	
Morden Lady of Koogan	A. W. Padbury	Guernsey	722	3	1	23–9–23	365	13,181	3·81	502·59	31	
Annetta III. of Wollongbar	Department of Agriculture	do.	589	2	8	2–9–23	365	6,589	6·07	400·37	18	
Gladness of Wollongbar	Department of Agriculture	do.	452	5	5	25–9–23	365	7,470	5·05	377·31	16	
Rocket of Wollongbar	Department of Agriculture	do.	541	4	5	14–10 23	365	7,244	4·01	355 69	14	

PHOSPHATIC FERTILISERS AS MANURES FOR GRASS LAND.

A. B. Adams,

Dipl. Agric., Agricultural Adviser.

On analysing the fodder plants it is found, on the average, that 95 per cent. of the dry matter (that is the material left after drying at 212 deg. F. until of constant weight) is obtained from the atmosphere. The remaining 5 per cent. is obtained from the soil, and, though in such small quantity, is extremely important, as if any of the essential constituents are absent or unavailable plants cannot grow.

Carbon, hydrogen, oxygen, nitrogen, phosphorus, potash, calcium (lime), iron, magnesium, sulphur, and probably chlorine, are the elements essential to plant growth; of these the carbon is obtained from the atmosphere, some of the nitrogen—in the case of the leguminous plants (the pea and clover family)—is also obtained from the air, but the legumes are, when young, like the great majority of plants, and require their nitrogen in solution as some compound of nitric acid. Of the elements enumerated only nitrogen, potash and phosphorus are usually in short supply in the soil, and this is not always because the soil is actually deficient in the substance, it is often due to the substance being in an insoluble form. The unavailable nitrogen may be present as proteins, organic acids, etc., and as plants make use of little but nitric nitrogen the unavailable substances have to be converted into nitrates by bacterial action before being of much use. Potassium when unavailable is usually in the form of undecomposed rock residues and in the double silicates of the clay. Calcium (lime) is hardly ever in insufficient supply as plant food. When liming is required it is generally for its chemical or physical effect on the soil. Iron is also nearly always sufficiently plentiful, though in isolated cases when soils are deficient in iron this is generally shown by cattle becoming unhealthy when depastured on such deficient soils before it is to be noticed in the plant. (See "Bush Sickness Investigation," by B. C. Aston, page 30, New Zealand *Journal of Agriculture*.) Sulphur in a few cases is in short supply. The hydrogen and oxygen are taken up as water, and the other elements, with the exception of phosphorus, are always in sufficient abundance.

The soil phosphorus is usually present as a compound of phosphoric acid with lime, iron, or alumina; when combined with the two last it is almost certain to be too insoluble to be of any use to the plant. It is largely owing to a soil analysis not showing what portion of the various substances present are actually available as plant food, that soil analyses are such poor guides

to the farmer in his use of manures. A good example of such a case is given by Ingle when writing of the limitation of chemical analysis:—

Table 1.

	Soil A.	Soil B.
Fine soil contains—	per cent.	per cent.
Moisture	3·13	1·70
Loss on ignition	10·85	7·79
(ctg. Nitrogen)	(0·274	0·247)
Insoluble matter	67·88	80·28
Ferric Oxide and alumina (Fe_2O_3 and Al_2O_3)	15·61	8·16
Lime (CaO)	0·29	0·13
Magnesia (MgO)	0·31	0·21
Potash (K_2O)	0·86	0·48
Phosphoric acid (P_2O_5)	0·15	0·12
Not determined (Soda, Chlorine etc.)	1·42	1·13
	100·00	100·00

"From these figures it would appear that soil A is better provided with lime, potassium and phosphoric acid than soil B, and inasmuch as there is also more nitrogen present one would conclude that soil B would receive much more help from phosphatic and lime manures than soil A. Actual practice shows exactly the opposite, for it is found that basic slag produces a large increase and great improvement in the crop on the field from which soil A was taken, while the field from which soil B was derived does not respond to applications of basic slag."

Unfortunately Australian soils are generally deficient in phosphoric acid. Table 2 gives average analysis of ten English soils and a large number of Victorian and Western Australian soils:—

Table 2.

Analyses of English, Victorian, and Western Australian Soils.

	Phosphoric Acid.
	per cent.
Ten English Soils	0·098
Victorian Wheat Soils	0·055
Western Australian Wheat Soils	0·025
Fourty-three soils from South-West of Western Australia ...	0·040

By Dyer's availability method, the Victorian soils not only contained a lower percentage of phosphoric acid, but the availability was lower.

Of the 43 South-West soils noted above, 29 of them averaged .024 per cent. P_2O_5. As it is generally agreed that under .05 per cent. is poor, .05 to .1 per cent. is low, and over .1 normal to good, it is easily understood how it is that most of our soils respond so well to phosphatic manures.

ACTION OF PHOSPHORIC ACID.

One of the most important effects of P_2O_5 is its stimulating effect on the young plant, chiefly caused by its action in promoting root growth. This was noticed by Sir John Lawes in 1847, and was strenuously contradicted by

Liebig. Later experiments have proved that Lawes was quite correct. With cereal crops it is found to promote early maturity. This is very useful with the wheat crop in the drier districts. This stimulating effect on the roots enables the plant to make better use of the other plant foods present in the soil. It is probable that the addition of P_2O_5 to a soil deficient in this necessary substance has still another effect. It is common knowledge that a fertile soil is not a mass of dead mineral matter, but contains enormous numbers of bacteria; these bacteria are low forms of plant life and require similar substances to other plants for their nutrition. We are therefore justified in assuming that by adding to the soil a substance which has been in short supply, the soil bacteria are enabled to increase and the beneficial ones will make otherwise inert material available for the crop.

MANURES CONTAINING PHOSPHORIC ACID.

Manures are sold in this State on a guaranteed analysis, the phosphoric acid being shown as phosphorus pentaxide (P_2O_5). In many countries it is shown as percentage of tricalcic phosphate ($Ca_3P_2O_8$). This makes comparison difficult between manures used here and those used in other countries. For instance, superphosphate sold in this State as containing 22 per cent. phosphoric acid would be sold in England as 48 per cent. tricalcic phosphate rendered soluble. According to the Fertiliser Act a certificate must be supplied to the purchaser by the vendor showing the percentage of nitrogen, potash, and phosphoric acid, and the last is shown as water, citrate and acid soluble P_2O_5. The water and citrate soluble forms of P_2O_5 are readily available to the plant, but that shown as acid soluble varies greatly with the material and fineness of grinding. Very finely ground bonedust is easily available in this climate, while some of the rock phosphates, even when finely ground, are of very low availability. In the analysis of both bonedust and ground rock phosphate the P_2O_5 is shown as acid soluble.

When purchasing manures it is advisable for the farmer to consider first what kind of fertiliser is most suitable for his crop and land, and, having decided on that point, to purchase the fertiliser which will give the required plant food at the lowest price. The comparative costs of manures are often estimated from the so-called unit values. The unit is one per cent. in one ton, *i.e.*, 22.4 lbs. equals one unit. The unit values are somewhat arbitrary, as a unit of acid soluble phosphoric acid in bonedust and ground rock phosphate would not be valued at the same rate. Nitrogen in sulphate of ammonia and dried blood would also be valued at different rates. At the present time the unit value of water soluble phosphoric acid in super in Perth is about 5s. 2d., and citrate soluble should be worth nearly as much. If it were desired to purchase superphosphates and there were two brands on the market, one containing 22 per cent. and of this 20 per cent. water soluble, 0.5 per cent. citrate soluble, and 1.5 per cent. acid soluble, while the other contained 17 per cent. water soluble, 0.5 per cent. citrate soluble, and 0.5 per cent. acid soluble, then, with water soluble P_2O_5 valued at 5s. 2d., citrate soluble at 5s., and acid soluble at 1s. 2d. per unit, the 22 per cent. would be worth 20 $\times$ 5s. 2d. + 0.5 $\times$ 5s. + 1.5 $\times$ 1s. 2d. = £5 3s. 4d. + 2s. 6d. + 1s. 9d. or a total of £5 7s. 7d. per ton, and the 18 per cent. grade would be worth 17 $\times$ 5s. 2d. + 0.5 $\times$ 5s. + 0.5 $\times$ 1s. 2d. = £4 7s. 10d. + 2s. 6d. + 7d. = £4 10s. 11d. per ton.

In practice the higher grade manures would be the best buying, because after paying railway freight and cartage on to the land the higher grade manure would work out at less cost per unit. For instance, if the freight to the nearest siding is 10s. and the cartage to the farm 5s. per ton, then the cost of transport per unit will be 8.18d. for the higher and 10d. for the lower grade manure.

The unit values are of use when comparing manures in the same class, but are of little use when comparing manures of different types.

(To be continued.)

WESTERN AUSTRALIAN AGRICULTURAL PRODUCTION.

Value of Exports.

Year.	Wool.	Wheat.	Flour.	Fruit (Fresh).	Total.
	£	£	£	£	£
1910 *a*	966,870	406,326	25,427	5,506	1,404,129
1911 *a*	925,450	386,922	54,565	16,103	1,383,040
1912 *a*	1,035,666	100,148	121,730	33,396	1,290,940
1913 *a*	976,818	763,798	239,840	32,274	2,012,730
1914 *b*	182,039	1,343,856	158,011	68,280	1,752,186
1915 *c*	817,630	10	26,630	46,417	890,687
1916 *c*	1,273,183	1,023,362	213,991	22,236	2,532,772
1917 *c*	1,420,291	1,619,630	424,361	82,014	3,546,296
1918 *c*	535,819	437,709	693,577	35,689	1,702,794
1919 *c*	1,952,141	399,986	1,294,482	57,021	3,703,630
1920 *c*	3,937,106	2,541,698	2,526,620	150,087	9,155,511
1921 *c*	2,388,119	2,930,179	1,075,037	121,335	6,514,670
1922 *c*	3,202,145	3,037,997	1,024,632	176,104	7,440,878
1923 *c*	3,232,596	1,471,100	670,909	237,940	5,612,545
1924 *c*	4,237,152	2,542,626	824,743	188,949	7,793,468

a Year ending 31st December. *b* Six months ending 30th June.
c Year ending 30th June.

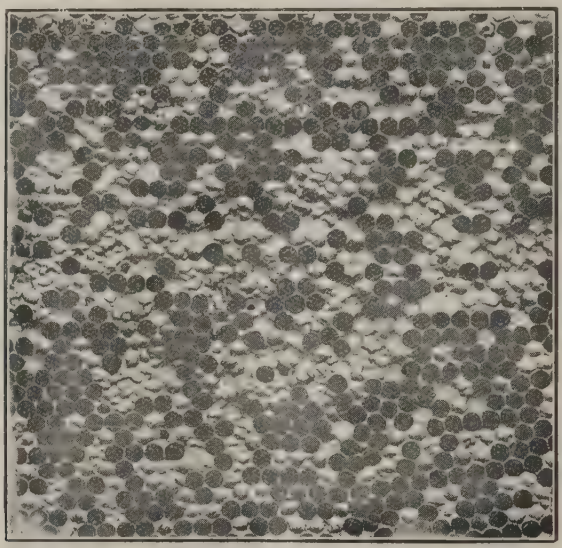
ACKNOWLEDGMENT.

It should have been stated in September issue of the "Journal" that the illustrations on pages 311 and 313 included in the article on "Minerals and Health of Cattle" by Mr. A. B. Adams, Agricultural Adviser, were reproduced from the "South African Journal of Agriculture" for May of this year.

BEE DISEASES.

H. L. Cailes,
Apiculturist.

During the past season many inquiries have been received on the subject of "bee diseases." Specimens of comb containing dead brood supposed to be affected with some contagious malady have also reached me, but in only one instance could it be said that the trouble was of a serious nature. In this case examination revealed the presence of "Foul-brood"—bacillus



Foul Brood—Bacillus larvae.

larvæ—in the advanced stage. This is the most dreaded form of "foul-brood." The owner of the bees acted wisely in forwarding the specimen for examination and identification. He was not acquainted with the behaviour or symptoms of diseased bees and their brood, and on this occasion considerable expense was saved both to himself and his neighbours by expeditious treatment. Of the known diseases in this State "foul-brood" is the most serious one we have to contend with. In many cases the symptoms are quite unknown to the bee-keeper, but prompt action is urged in sending specimens—securely packed—of diseased or dead brood to the Department of Agriculture for examination.

The small or town-lot bee-keepers must not think that their one or two weak or sick colonies are of no importance in this connection. Should their colonies become weak or die out, from any cause whatever, and the owner has little or no knowledge of bees and their ailments, immediate steps should be

taken to ascertain the reason for the demise or apparent weakening. Small, neglectful bee-keepers might easily become a very serious menace to the industry if this advice is not taken. Of course these remarks apply to all bee-keepers—both large and small—and prompt action will not only be appreciated by this Department, but more especially by the men and women endeavouring to make a living at apiculture. Moreover, it is encumbent upon all apiarists to report diseases in accordance with the Contagious Diseases Act (Bees) of 1899. Just here it must be mentioned that an amended Act in the interests of apiculturists will soon come into operation, and should be appreciated by all practical bee-keepers throughout the State.

The present outbreak of "foul-brood" is so widely scattered that the cause of its dissemination must be guarded against at all times. Honey from affected colonies, while not harmful to human beings, constitutes a ready medium for the dissemination of the diseases. During dearth periods empty bottles and tins thrown on the rubbish heap are visited by the bees, and they may have contained diseased honey which came from affected apiaries hundreds of miles distant. The truth of these remarks is strongly suggested by the fact that the first outbreaks of the disease were discovered in our town apiaries adjacent to the seaports. Investigations point to the fact that the imported honey contained germs, and was the means of its introduction into this State. Further suggestions of this nature come from South Africa—"foul-brood" Bacillus pluton (the "foul-brood" in Western Australia at the present time known to us is Bacillus larvæ of American "foul-brood"), was unknown to them until about March, 1918, also during and after the Boer war a considerable quantity of honey (not Australian) was imported by them, only to be followed by serious outbreaks of European "foul-brood," Bacillus pluton. All precautionary measures should be adopted to prevent its introduction into the apiary, and considerable care should be exercised when purchasing second-hand bee material.

The importation of honey into this State is steadily increasing, and with it comes our ever increasing troubles from "foul-brood." Unfortunately our honey supply is not sufficient for our own requirements, and whilst we import honey there is always the possibility of introducing disease.

The illustration accompanying this article will give some idea of the appearance of affected brood. The "sealed" or "capped" brood is very irregular in appearance, when once the disease is firmly established and the cappings also appear to be more or less concave many of them being perforated. If these cells are opened the dead larvæ will be found lying on the lower side of the cell, usually towards the bottom, having assumed a shapeless condition and of a light coffee brown colour which gradually becomes darker with age until the diseased matter dries up to a black scale lying in the position already indicated. In the earlier advanced stages this matter emits a decidedly objectionable odour, described by apiarists throughout the world as strongly resembling the smell of an old glue pot. It often happens, when there are a few disease cells in the hive, that there is a total absence (to the casual observer) of the odour referred to. It may also be the case that the cappings of the cells are not perforated, but in this condition they can usually be detected by the sunken and slightly darker appearance to the surrounding healthy cells. By removing the capping of any cells of a suspicious nature, the larvæ will be seen to be affected in the manner already described, and an almost infallible test of the presence of "foul-brood" Bacillus larvæ is the

adhesive nature of the diseased matter prior to its drying off into a black scale. This condition is determined by inserting a match or pricker of any description into the dead larvæ, which will adhere to the stick and stretch up to an inch or more. The unsealed larvæ are effected in a like manner, but are often cleaned out by the bees if they are not too severely affected and the colony has not been seriously reduced in numbers.

Remedial Measures.—Whenever a colony is found to be affected all exits (if any) other than the main entrance should be closed and the main entrance contracted considerably. If the colonies are too weak to be profitably treated they had better be closed completely at nightfall and then carried away from the apiary so that the bees, hive, and fittings can be treated according to their value. If very weak the bees should be killed, but extreme care must be exercised not to allow a single bee to escape and return to the old stand or, perhaps, enter other hives adjacent thereto. The internal fittings should be burned, but the hive body, the lid, and the bottom board may be saved if made of good material. They should be thoroughly cleansed of all particles of comb, wax, propolis, and debris—which should be burned —and then well scorched with a blow lamp and painted.

Medium to strong colonies may be saved by shaking the bees—without being removed from their original stand—on to a few frames of starters of comb foundation which may be placed into a clean hive, or benzine case for the time, and allowed to remain for at least four days. By this time the bees will have used in various ways, more especially in the building of comb, every particle of honey contained in their honey sacks and carried with them at the time of shaking. At the expiration of four to six days it is advisable to shake them again into hives of a permanent nature, giving them frames of full sheets of foundation to assist them to build up quickly.

Treatment of a diseased colony must be performed during the honey flow or under conditions akin to normal. When a large number of colonies are to be treated, they may be united and subsequently shaken if the owner should wish to save the bees. On no account should honey from affected colonies be smeared about on hives and appliances or given to the treated colonies, as this is the very thing that we are trying to avoid when we shake them twice. Some apiarists shake them once only, as the disease is carried thereto per medium of the honey. Honey taken from diseased stocks should be boiled thoroughly before being used, and appliances in the way of hive tools, smoker, etc., and even one's hands, should be thoroughly cleansed before passing on to the manipulation of healthy stocks.

It is a wise plant to introduce Italian queens to all hybrid stocks, as experience goes to prove that they resist all bee diseases better than an inferior strain of bees.

In conclusion the writer particularly desires that all bee-keepers desiring advice on this or other subjects pertaining to apiculture will communicate with the Department, and wherever possible personal inspection of their apiaries will be made.

SEASONAL NOTES.

Having recently completed a brief tour of the agricultural areas, I find that the work in the apiary for the present time and for at least two months to come, is mainly in extracting and general manipulations.

The swarming season having passed very useful and desirable work may be done to prepare colonies for the honey flow to come during midseason and later on in the autumn.

I have noticed particularly that many of the colonies are headed by very inferior queens, and that the bees are not in the condition likely to prove the most profitable to their owners, in so far as colonies headed by inferior queens cannot produce as the should through lack of numbers.

In all probability our heaviest honey flow, which usually comes from the marri, will come again this year, and bee-keepers may improve their situation by superseding all inferior queens in preparation for the honey flow which will follow later in sufficient quantity to repay any outlay involved.

Great care should be taken when extracting, especially in the coastal areas, that inferior and better class honey should not be mixed indiscriminately during the operations. Should it be desirable to dispose of the inferior grades of honey, it is much easier to blend when taken from the hives in the manner suggested.

The anxiety of the bee-keeper during the swarming period will have passed by the time these notes reach you, and the non-commercial man—especially the inexperienced—will be the person needing the greatest amount of assistance at this time.

In certain coastal districts the honey extracted during January and February is much inferior as regards colour and flavour to that coming from Marri during February to April, and should therefore be wholly removed when it is seen for certain that the Marri will yield. It is then possible to extract every available pound of the better grade for marketing purposes, while the inferior honey may be returned in the form of winter stores.

The necessity for the improvement of the quality of bees now in existence cannot be too strongly emphasised. Unfortunately very little attention is being given to the re-queening of stocks, and until bee-keepers realise the importance of this work the general returns possible will never be secured.

THE VALUE OF PHOSPHATES.

Phosphoric acid is a most important substance in animal nutrition. In combination with lime and magnesia, it forms 85 per cent. of the ash of bones, and the ash of muscular and nervous tissue contains approximately 35 per cent. of phosphoric acid. All tissues provided for the maintenance of the young are very rich in phosphorus, *e.g.*, eggs, milk. Experiments carried out have demonstrated that wherever phosphoric acid is applied artificially there is a substantial increase in the phosphate content of the herbage. It follows then that the top-dressing of pasture lands with liberal dressings of water-soluble phosphates brings about a marked increase in the phosphate content of the grasses, clovers, etc., grown on that soil and an improvement in the health of the animals grazing on that pasture.

FARMING AND FORESTRY.

H. R. Gray, B.A., Dip.For. (Oxon.),
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In these enlightened days it is hardly necessary to emphasise the importance of forests, but it is proposed merely to touch on the relationship of forestry to agriculture and to show that the interests of the two are not necessarily antagonistic. It may be mentioned, in passing, that, although it is often said that advancing civilisation will find substitutes for wood, the contrary is the case. From actual statistics it is shown that the higher the industrial development of a country the greater the consumption of timber per head of population.

"What is forestry?" is a question often asked. Sir William Schlich, late Professor of Forestry in Oxford University, and one of the greatest living authorities on forestry, puts the matter in a nutshell in the comprehensive statement:—"By forestry is understood the human action directed to the production and utilisation of forest produce. It is based on the yield of the land, and forms a branch of agriculture in its widest sense."

Forestry, being based on the yield capacity of the land, competes with various other industries similarly situated. The case of agriculture demands first consideration, because it produces food for man and animals, whereas forests produce chiefly cellulose, and accessory products. Generally speaking, therefore, forestry must give way to agriculture. It is obvious, however, that certain areas must be maintained under forest for the benefit of the community as a whole. In these circumstances, it is fortunate that valuable forests will often grow on land that is very inferior from an agricultural standpoint. A striking example of this in Western Australia can be seen on the Darling Ranges, where the laterite-capped ironstone ridges, quite unsuitable for agriculture, carry very fine jarrah forests. So many areas have been taken up in the jarrah belt, found to be quite unsuitable for agriculture, and afterwards resumed by the Crown, that not many settlers are likely to require any of these areas for their purposes. Their only use, from an agricultural standpoint, is from the grazing afforded, but on areas such as this it is very bad economics to fire the valuable forests, and thus damage growing timber, retard the rate of growth, and render a satisfactory regeneration almost impossible, for the sake of providing inferior grazing for a few head of cattle.

A belief is current that fire does not damage the forest, as, on casual inspection, the jarrah bush appears to have abundant regeneration, but if this regeneration be carefully examined, it will be seen to consist of saplings so damaged by fire as to preclude the possibility of their ever developing into good mill logs. One has only to see the size of a jarrah seedling 12 months old, a tiny plant but a few inches in height to realise the fallacy of the belief that even a so-called "creeping-fire" is not harmful to the forest. In collecting data for a working plan at Collie, it was found that, of the saplings under 10 inches in diameter, 2.45 were sound, against 21.2 useless ones, per acre.

Much more could be said on the subject of the damage by fire to the forests, but I think the general consensus of opinion is now that fire is harmful to forests, and, as the forests belong to the people, it behoves everyone to assist the Department in their work of controlling forest fires. Such areas as those mentioned should be permanently dedicated for the growth of trees and agriculturists and foresters are not likely to quarrel about them.

It should be borne in mind that, throughout the jarrah belt, in the gullies and flats, are pockets of good soil taken up for various forms of agriculture. No sane forester desires to reserve them to the forest. The farmer or orchardist taking up such land should not, however, look upon the adjacent forest as his enemy, to be hacked, and burnt wherever possible. For, owing to the fact that forest work can usually be carried out any season of the year, the forest is a potential source of labour to augment the settler's living during his slack months.

As regards the fertility of the soil required by forests, it should be noted that the physical properties, *e.g.*, depth, porosity, and degree of moisture, are more important than the actual chemical composition. The results of researches go to show—

(1.) That the substances required for the nutrition of forest trees are qualitatively the same as those required by field crops.

(2.) That some species of the tree growth require, for the production of wood and leaves, almost as much of these substances as field crops, but that others, *e.g.*, certain of the conifers, require much smaller quantities. As an instance, some pines are satisfied with one quarter of the mineral substances required by field crops.

(3.) For the production of wood alone (excluding the leaves) forest trees require much smaller quantities of the above substances than field crops, thus beech takes one-ninth, Scots pine one eighteenth, and an average of many species about one-twelfth of the quantity required by field crops.

Of the rarer substances potash and phosphoric acid trees take, on an average about one-twentieth of the quantity necessary for field crops.

(4.) Almost any soil, therefore, can furnish a sufficient quantity of mineral substances for a crop of trees, provided the leaf mould, *i.e.*, humus is not removed, and good soils will continue to do so, even if some portion of the leaf litter is removed.

(5.) Poor soils, which are not capable of producing a crop of an exacting species of tree growth, may yet yield a fair return if planted with less exacting species.

(6.) By the addition of organic matter, *e.g.*, leaves, twigs, and other decomposed vegetation poor soils may be improved by carrying a crop of trees, and may, therefore, be capable of supporting a more exacting species for the second rotation.

Humus is to the forests, then, what manures are to field crops, and the importance of protecting humus from forest fires and other forms of injury will, therefore, be understood.

Coming to the more fertile land of the wheat belt, however, the case is rather different. Here the best forest is usually found on the most fertile land. Under these circumstances, the farmer naturally clears every available acre for crops. It is unfortunate, however, that in the laying out of

Brown Mallet of Western Australia (*E. astringens*), the bark of which contains from 40 to 57 per cent of tannin.

blocks more regard was not paid to the permanent dedication of certain areas as forest reserves. The clearing of land has been carried out in such a wholesale way that, in future, the shortage of timber for settlers' requirements, and even for firewood, will be very pronounced. Then, too, this wholesale clearing deprives the country of shelter from desiccating winds, leads to shifting sand, and the history of Mesopotamia, Algiers, large portions of China, and other once fertile agricultural lands may be repeated in this State. It may be necessary to create large reserves, at great expense, of the very species which have been so light-heartedly destroyed.

The rise of salt is another real danger which frequently follows the clearing of all timber from an area. The explanation would appear to be that the subsoil moisture is saline, and the clearing of tree growth and vegetation leads to a rise in the subsoil moisture. The evaporation of this moisture from exposed soil gradually carries the salt up, depositing it in the upper layers of soil, which are thus rendered unfit for crops. Many instances of this are constantly being brought before the notice of the Department, but one very clear demonstration of this fact is shown on the Helena catch-

Part of the Helena Catchment Area which supplies the Mundaring Reservoir, showing the extensive ringbarking of the hills, which has resulted in increased salinity of the Helena River.

ment area. From the Mundaring Reservoir is obtained the water supply for the goldfields water scheme. When the weir was first constructed doubt was entertained as to whether the basin behind it would be filled, and, to increase the run-off of the catchment area, and to decrease the loss of moisture by transpiration through the leaves of trees, all timber on the area was systematically ringbarked. This action was followed by a marked increase in the salinity of the water, the average salinity from Mundaring being 22 grains per gallon, as against that of Victoria Reservoir (the trees on the catchment area of which have not been ringbarked) of 13.4 grains per gallon. That is an increase of 6½ grains per gallon as a result of ringbarking the timber on the catchment area.

The regulation of the movement of soil moisture is also beneficially affected by the forests, which have rightly been called the mother of rivers. The trees themselves and the leaves, twigs, and humus on the forest floor all help to retard storm flows, and so prevent excessive flooding. This litter on the forest floor acts as a sponge, which retains moisture which would otherwise run off the area. As an illustration, certain species of moss to be found growing under pine forests are capable of absorbing up to five times their own weight of water. Some of this moisture, which would have gone to waste, is, of course, evaporated, and some is taken up by the roots, but the balance penetrates into the soil, and has a decided effect on the sustained flow of springs. When a catchment area is covered with forest, the quantity of water which flows over the weir or dam, as the case may be, and so runs to waste, is diminished in the rainy season, and the seepage water which finds its way into the reservoir during the summer months is considerably increased. It is largely due to this fact that a quantity of water equal to nearly two and a-half times its capacity is annually drawn from Victoria Reservoir.

Another advantage of tree growth on catchment areas and other hills is due to the fact that the network of roots binds the soil together and prevents erosion. The effect of heavy rains in carrying loose soil down bare slopes and causing land slides, scouring out ravines, and depositing silt and débris on fertile land is a very real danger. As an illustration, it was found in Switzerland that the amount of silt in water from a catchment area in its natural condition was about one-third of that from a catchment area that had been cleared. The depositing of such débris frequently causes obstructions and diversion in river beds, giving rise to floods and swamps.

It has been shown that forests are a necessity to the community at large, and to agriculturists in particular, but, owing to the length of rotation on which trees generally have to be grown, and the fact that expenses incurred in starting forests are accumulating at compound interest, forests do not generally yield a high rate of interest on the capital invested. For this reason, the maintenance of forests is generally considered a function of the State, in the same way that the State provides roads and other forms of public utility.

Persons who depend for their living on the produce of the land might, for the reasons given, be expected to be more concerned about the maintenance of forests than city dwellers. Further than this, in their own interests it is desirable that some action should be taken by settlers in the protection of existing tree growth or the planting of trees on their properties. Among the advantages to be gained thereby are—

(1.) The assurance of an adequate supply of fencing material and other timber for general farm requirements.

(2.) A supply of firewood.

(3.) Formation of wind breaks.

(4.) Provision of shade for stock.

(5.) Provision of ornamental trees for the homestead.

(6.) The establishment of valuable assets in small wood lots of pines, mallets, wattles, etc.

In regard to fencing requirements, it is not necessary to emphasise the value of jam posts for this purpose, or the growing scarcity of these posts in some districts.

In connection with the growth of jam (*Acacia acuminata*) it should be noted that the fast-disappearing tree of this State, namely, sandalwood (*Santalum cygnorum*), is a root parasite, whose favourite host plant in the wheat belt, at any rate, is jam. When it is realised that sandalwood from private property is worth up to £25 per ton, that in suitable areas, two to five tons of heartwood per acre (it is only the heartwood of the trunk, limbs, and roots which is valuable) should be obtained in from 25 to 35 years, according to the rainfall, it will be appreciated that it is quite worth while to attempt to grow sandalwood with jam, and so achieve a dual purpose.

The value of planting trees, as a commercial proposition, is becoming more and more recognised by owners of property. In this connection the planting of certain species of pines holds forth considerable possibilities. This State has no native softwoods, and has to depend on supplies

Young Pines—2 years after planting—in a Departmental Plantation in the Mundaring District. These are from 8 to 10 feet high.

from abroad. Not only is it undesirable from a national point of view to send money out of the State for this purpose, but the fact that the end of supplies in exporting countries is in sight behoves the State to become self-supporting as soon as possible in respect of its softwood supplies. At a meeting of the British Empire Forestry Conference held in Canada in 1923, at which were present representatives of every forest service in the Empire, the following resolution was passed:—

> "In view of the great and increasing drain on the softwood forests of the world, it is incumbent on every part of the Empire to conserve and augment its own resources of growing coniferous timber."

From this it is clear that a market for suitable softwood timber is assured, and that the prices are likely to be higher in the future. The species offering the most attractive financial prospects in this State is *Pinus insignis*.

This species will thrive on a rainfall down to 18 inches, but the soil must be of fair quality. On pure sand it may show vigorous and rapid growth for a few years, but will then die off. Plantations of *Pinus insignis* made by the Government on poor soil years ago showed this tendency, whereas plantations of *Pinus pinaster*, the maritime or cluster pine, continued their healthy development. It will be seen, therefore, that if good land is available for planting pines, *Pinus insignis* should be the species chosen, and *Pinus pinaster* if only poorer sandy soil is available. In suitable localities

Pinus insignis, at Hamel Nursery, 16 years old.
Some of the trees are over 80 feet in height.

the yield per acre which may be expected from *Pinus insignis*, in 30 years, may reasonably be put down at 6,000 cubic feet of sawn timber. Many instances have been recorded of higher yields than this. On a rotation of 35 years the yield might be 8,000 to 10,000 cubic feet. Taking the price of this timber at 6d. per cubic foot, the return on a 30-year rotation would be £150, and on a 35-year rotation from £200 to £300. As has already been indicated, there is every possibility that prices will be increased in the future, and the figures quoted may be taken as a conservative estimate. The timber works up easily to a fine face and takes polish well. For doors, frame timber for houses, floors, ceiling, wheelbarrows, gates, sides and bottoms of drays, broom-heads, and other purposes for which ordinary deals are used, it is eminently suited. It is particularly suitable for case-making, as it does not split with nailing as so many other timbers do.

It is considered in New South Wales that the cost of formation should never be more than £7 per acre, but many plantations have been established at a lower cost than this. For instance, clearing might be put down at £1 10s. per acre, planting £2 10s. per acre, and planting stock 5s. per acre, if it is raised on the site. If cleared land is available the cost of clearing, of course, will be avoided. The cost of formation of a pine planta-

tion to a farmer is represented by little more than his own time and, as there are many days in the year which most farmers can easily spare, the actual cost to him should be a very small item. The advice of the old Scotch farmer to his son: "be always sticking in a tree, my boy; while you are sleeping it'll be growing," is well worth following.

On most farms it should be possible to set aside, say, 30 to 40 acres of fairly good land for pines. It is desirable to work for a sustained yield so that an equal area should be planted each year, and, after the 30th year the first area planted would be harvested and re-stocked either by natural regeneration from seed or re-planted, so that a continuous yield is assured.

Brown Mallet (*Euc. astringens*), is worthy of attention by farmers. The habitat of Mallet is a very large area extending some miles on both sides of the Great Southern Railway, between Pingelly in the North and Tambellup in the South.

Mallet generally grows on poor laterite ironstone ridges, which are of little use for any other growth of economic use. As is well known, the bark of this tree has a high tannin content (40-57 per cent.).

Farmers with mallet regrowth on their properties will be well advised to protect it from fire until it has reached a minimum girth of, say, 15 inches. The trees should then be felled when they are stripped, and the area burnt, when good natural regeneration should result.

It will be seen that with systematic working a permanent yield should be secured with little trouble or expense.

Limitation of space here precludes the possibility of dealing exhaustively on the choice of species to plant and methods of preparation, yields, etc., but the Forests Department desires to assist agriculturists and others in the cultivation of trees, whether for the purpose of wood lots, wind-breaks, shade or ornaments, etc., and any advice that it is possible to give as to the most suitable species to plant in any given locality or for any of the objects enumerated above will willingly be supplied.

Wattle culture is another form of forestry likely to prove attractive to settlers, particularly as some species will grow on poor soil. In areas of comparatively low rainfall in this State the most suitable species is Golden Wattle (*Acacia pycnantha*). This is a species which will grow on poor soil. The bark of this tree possesses a high tannin content.

On the other hand, the Department looks to farmers for support in the national duty which it has to perform, which, although it may involve the enforcement of certain restrictions and regulations, is for the benefit and well-being of the community as a whole.

SMYRNA FIG CULTURE IN WESTERN AUSTRALIA.

Chas. Simmons,
Orchard Inspector.

The commercial dried fig is the product of the fig tree known as the Smyrna fig. This variety of fig tree differs from the Mediterranean or Adriatic fig with which we are so familar in this State in that the Smyrna varieties are not self-fertilising. They are dependent for fertilisation on the pollen of the Capri, or wild fig, and the existence in the Capri fig of a minute wasp as an agent to carry the pollen from the Capri to the Smyrna fig. There are many named varieties of Smyrna fig trees, but because of its superior appearance, flavour, size and keeping qualities the Lop Smyrna (*Lob. Injir*) has long been recognised as the fruit most suitable for commercial use. The trees of this variety that have been planted in Western Australia are making good headway. They compare favourably with the common Adriatic fig trees in growth, production, and in their adaptability to the soils of the coastal area of the State. The Lop Smyrna is a strong upright grower, and after being once pruned to shape these trees do not require any further pruning. In a commercial orchard the trees should be planted 40 feet apart, and require cultivation and manure in the same manner as other orchard trees.

Capri fig trees are planted at the ratio of one to every ten Smyrna trees to provide enough wasp bearing figs to caprify the figs on the Smyrna trees. On 20th December of each year the main part of the crop of Smyrna figs are about five-eighths of an inch in diameter. They are then awaiting fertilisation. At the same time the spring crop of Capri figs is ripe and the minute wasp, dusted with the pollen of the Capri fig, is emerging from the eye of the Capri fig. The Capri figs are gathered into small baskets made of wire netting, each holding about six figs. Three such baskets are enough to fertilise the crop of a very large Smyrna tree. These baskets are hung in the Smyrna trees, and after four days' interval are refilled with Capri figs: a third refill may be necessary to caprify the most backward of the young Smyrna fig crop. The Smyrna figs are receptive to pollen from the time they are three-eighths of an inch in diameter up to one inch in diameter, but after a certain limit of size and time without caprification the figs become yellow and fall off. The wasps come out of the eye of the Capri figs dusted with Capri pollen, seeking a place wherein to lay their eggs: after entering the Smyrna fig and while crawling over the florets and trying to oviposit, the pollen falls upon the stigma of the fig florets and produces fertility in the Smyrna f.g. The wasp, unable to deposit her eggs, becomes exhausted, creeps into the scales at the eye end of the fig and dies.

In March the figs are ripe enough to cure and pack. The fig is only fit for drying when it is dead ripe: therefore, the fruits must be gathered several times as they become ready. In picking the figs care should be taken to retain the stalks. The fruit is placed in perforated buckets, and dipped in and out of a solution of three ounces of salt to a gallon of water. The brine solution must be kept at boiling point, and each pailful of fruit dipped in and out quickly four or five times. The figs are then spread upon trays,

eye upward, and the trays are laid in the sun for from six to ten days. After two or three days of drying the syrup in the figs has become jellied, then the fruit is turned over to expose the under side to the sun. If picked when properly ripe it should not take longer than six days to dry the fruit, but as figs dry unevenly those not quite dry enough can be left a day or two longer. The figs are then placed in sweat boxes, having a loose lid fitting inside the box; a heavy weight is put on the lid to press the figs into a compact mass and bring them to a uniform condition. In a week's time the figs are ready to pack, but they should first be dipped in a 2½ per cent. solution of boiling brine. The fruit is then spread upon trays and dried as quickly as possible. All overdried or too poor fruit is removed, and the bulk sorted into two or three qualities. The second dipping makes the skin of the figs smooth, soft and pliable, and in packing into cartons or small boxes the figs are worked to a flat shape between the finger and thum, presenting to the buyer a large round light-brown smooth fig, and is worth from 10d. to 1s. 2d. per lb. wholesale.

The Capri or wild fig tree is indigenous to Asia Minor. In America and Australia varieties of Capri have been cultivated and named. The best known in Australia are Roeding's California, varieties Nos. 1, 2, and 3; Robson's Special, and a local seedling called "Simmon's Capri." The last named is an accidental seedling tree found growing in the yard of a house in East Fremantle, now producing enormous crops of large Capri figs, which has, by itself, afforded a home for the fig wasp since its introduction in 1900. Capri trees produce an inedible fig usually dry, but in any case, as its flowers are simply a mass of tiny insects, the figs are not fit to eat. The trees exist apparently for the sole purpose of producing figs superabundant in pollen and fruit to afford a home for the fig wasp (*Blastophaga grossorum*). This insect passes its life from the egg stage to the adult state inside the Capri fig fruits.

The female wasp comes out of the eye of a ripe Capri fig ready to lay eggs, and forcing her way through the eye of a small Capri fig enters the hollow receptacle, deposits an egg in each of the gall flowers lining the inside of the fig, and dies. The Capri fig from that time on nourishes an insect in the ovaries of the flower instead of a seed, and each fruit carries several hundred wasps. The male, being the first to issue from the gall flower, immediately begins crawling over the surface of the flowers, gnaws an opening through the membrane of the gall and impregnates the female while she is still within it. The males are minute, brown, wingless insects, seldom found outside the fig. The females push their way out of the opening made by the male and issue from the eye of the ripe Capri figs, complete, winged, ready to find another fig in which to deposit their eggs, and so carry on another generation. The life cycle is accomplished in Western Australia in 12 to 13 weeks in the summer time, but in the winter season is extended to about 27 weeks.

Capri trees produce three crops of fruit during the year, and as each crop ripens the wasp emerges, and it is, therefore, necessary that as each crop ripens there must be small young figs also on the trees ready to take the wasp to carry on the next generation. The local seedling before mentioned has marked advantages over the Roeding's varieties in this particular, for whereas it was necessary to have either 1, 2, and 3 Capri or 1 and 3 Capri, the Simon's Capri carries the wasp by itself. In the timetable following, the dates of the issue of the wasp are approximate; the date given

being that on which the maximum of emergence has been observed. In reality the wasp issues in increasing, and then diminishing, quantities, as the crop gradually ripens and drops. The spring crop of Capri (or Profichi) bursts out with the leaves in August; it is ready for caprification in September and is ripe in December. The wasp from this crop is coming out at maximum rate on 20th December. The summer crop (Mammoni) bursts out in

Fig. 1.—The largest figs in the illustration are mamme figs from which the *Blastophagas* are issuing. The four smaller figs at the tip of the branch are profichi figs of sufficient size for the female insects to enter and oviposit. Note the female *Blastophagas* on the surface of the fruit.

November; it is ready for caprification in December (from Profichi crop), and is ripe in March. The wasp from this crop is coming out at maximum rate on 12th March. The winter crop (Mammae) bursts out in February; is ready for caprification in March (from Mammoni), and is ripe in September, and wasps from this crop caprify the spring or Profichi crop.

Capri figs, like the Smyrna figs, require cross-fertilisation, and the winter crop falls immature unless visited by the wasp. When a fig wasp enters a young fig it leaves its wings at the eye of the fig caught in the close scales at the eye. These can be seen, and makes it easy to judge whether the transference of wasp from Capri to Capri, or Capri to Smyrna, has been successful. Lest it should be thought that the culture of the Smyrna fig requires

a good deal of technical knowledge, let me say in conclusion that from time immemorial the ignorant Turks and Syrians of Asia Minor have successfully cultivated and dried this fruit. Once the fig wasp is established, as it undoubtedly is in the Capri fig trees in this State, the remainder of the work is easy and natural. The production of the figs both on Capri and Smyrna at the right time, is a never failing seasonal occurrence. Even if the winter frosts at some time remove the figs from the Capri trees, the wasps are easily renewed by a fresh supply of figs from some adjacent district. Western Australia with its rainfall, free open soil, and its long summer is wonderfully adapted to the natural drying of fruit and will, without doubt, produce a fine quality Smyrna fig.

VALUE OF AGRICULTURAL AND PASTORAL PRODUCTION.

The figures underneath show the marvellous expansion of primary production in Western Australia during the past ten years:—

Year.	Agricultural.	Pastoral.
	£	£
1914	3,097,140	2,057,735
1915	6,529,633	3,030,234
1916	5,889,663	3,670,966
1917	4,256,551	4 479,482
1918	4,757,763	4,544,144
1919	9,066,281	4,614,546
1920	8,732,984	4,379,849
1921	6,926,532	3,886,199
1922	6,495,948	5,117,314
1923	7,537,964	6,275,049

WINTER TRAPPING OF FRUIT FLY.

Chas. Simmons,
Orchard Inspector.

The pollard bait and traps supplied by the Department for the purpose of experiment on a commercial scale, and to ensure as far as possible that the district about Fremantle, where zone spraying is being carried on in the stone-fruit season, should be kept as free of fruit fly as possible in winter, were distributed in four commercial orange orchards at Spearwood, one in Hamilton Hill, and in six similar orchards at Coogee. The period over which trapping was carried on was from June 1st to October 30th, 1924. The last spraying by the Fruit Fly Board was done on May 15th, and recommenced on November 6th, 1924. This has ensured a continuous organised campaign against fruit fly from November, 1923, to November, 1924, over an area of about 40 square miles, and containing in total about 150 commercial and 40 non-commercial orchards. During June, July, August, and September count was kept of the number of fruit flies caught in the traps. The traps were visited every 10 days, were cleaned out each time, and refilled with pollard bait. The traps were hung in orange trees on the North-East side of the trees. The details of the catches were:—

	Spearwood.	Hamilton Hill.	Coogee.
June	116	4	167
July	97	27	126
August	185	7	321
September	7	...	16
October	...	...	...
Total	405	38	630
11 Orchards, Grand Total	1,073		

There is no doubt that traps and pollard bait are effective. The lure is irresistible to the female fruit fly. It is common to see them dash straight into the bait as soon as the traps are hung in the trees, but there are several objections to the adoption of trapping on a commercial scale. The traps to be effective should have a slip lid, so that the tin can be thoroughly cleansed of the old material and painted, otherwise they will last only one year. The light wire hangers should be decently adjusted so that the traps hang level in the trees. Such traps cost 1s. each. Every fruiting orange and lemon tree requires one trap and large trees two traps each, bringing the initial cost for traps to £5 per acre. The winter storms empty or partly empty some of the traps, and the heavy rains dilute the lure so that it becomes unattractive. This, however, is not of serious import, as during wet or stormy weather the fruit fly remains in concealment and can neither be trapped nor poisoned. The traps have to be renewed every eight to ten days in any case.

The greatest objection to trapping on a commercial scale is the time used in collecting the traps, taking them to some place where they can be washed, removing the lids, washing, refilling with bait and carrying them back again to the trees, or alternatively carrying washing water, refilling water and bait from tree to tree.

During the experiment of the past winter, both these ways were tried, also collecting, washing, putting the dry pollard bait in and carrying the tins back to the trees, and then going round with water for refilling. In any case, the average time taken was five minutes per tin. This would work out that a man with horse and cart in an orchard could attend to about two acres of orchard a day. This would have to be repeated every ten days. At a cost of 25s. a day, the cost therefore would be excessive. It should be distinctly understood that as a lure, the pollard bait is most effective. Its sole disadvantage is the time it would take to attend to the traps necessary in a commercial orchard. Future experiments with a liquid extract from pollard bait, which I understand Mr. Newman (the Economic Entomologist of the Department) is aiming at, would largely remove this disability.

Trapping is valuable and recommended as a guide to the quantity of fruit fly about, or for common use in household gardens, or even in a larger orchard where the cost of labour is no consideration. The writer could not recommend commercial citrus growers to carry trapping on during the winter as a continuation to the zone spraying with Newman's Fruit Fly Bait in the summertime, but would suggest traps scattered throughout the orchard as a guide to the amount of fruit fly about, combined with heavy sprayings with fruit juice bait on North-East and North-West side of the citrus trees. This should be done every seven days or as near as the wet days will allow.

DRY PICKLING SEED WHEAT.

The dry method of treating seed wheat for the prevention of smut, *i.e.*, by dusting the grain with finely powdered carbonate of copper is rapidly supplanting the old methods, and Western Australia probably leads the other States of the Commonwealth in this direction. Last year seven and a-half tons of copper carbonate were sold for this purpose to Westralian wheat growers. The new method has no injurious effect upon the grain or the young plant as it grows; it is simple and requires only that carbonate of copper at the rate of two ounces per bushel shall be mixed thoroughly with the grain. When carried out in this way it is as effective as any method, but need not be expected to achieve the best results if "slip-shod" methods are adopted. For this reason attempting to treat the seed when it is in the box of the drill is unsatisfactory, for it is impossible by this method to treat each grain with the fine particles of copper carbonate.

RAISING SEED IN THE GARDEN.

H. D. Larwood,
Potato Inspector.

The most important preliminary step to seed raising is the acquisition of good seed. Many good varieties of plants are often condemned through faulty seed. Avoid cheap seeds, buy only from reliable sources. The maximum amount of effort to produce crops from inferior seed is heart-rending, not to mention the utter waste of time and money. Get good seeds, buy only from reliable seedsmen, better still raise your own seeds by selecting only the very best plants for seed purposes. If buying seed, select a seedman who thoroughly tests out seeds before sale. When purchasing, avoid all seeds that are not well cleaned. Purchase seeds which have a fresh appearance and are fully developed. Many mistakes are made in the sowing of seed which cause partial or complete failure. Quite often good seed is planted under adverse conditions, and the seed and seedmen are blamed for the poor results obtained. There are four essentials for the good germination of seed:—

1. Life in the seed.
2. Air.
3. Moisture.
4. Heat.

The first essential is the responsibility of the seedsman or the original selector of the seed whoever he or she may be. The second, AIR, contains oxygen which enters into the chemical changes which takes place in the seedling. The third, MOISTURE, causes the swelling, and is more or less readily absorbed by the seed. The swelling time varies considerably. Soft seeds such as beans, etc., absorb sufficient moisture in a few days, while others with hard shells, such as palm seeds, often take several weeks and longer to absorb sufficient moisture before germinating. There are certain substances in seed which moisture, as a chemical, dissolves, and are rebuilt into other forms to serve as food for the young plant. Following this chemical stage comes the life stage or multiplication of plant cells, which is the growing plant. HEAT: requirements vary as to the degree needed by the different sorts of seed. Seeds are divided into three classes, cool weather or hardy plants requiring 50deg. to 70deg. Fah.; half hardy plants which require 60deg. to 80deg.; and tropical or hot-house seeds which will not germinate unless the surrounding temperature is from 80deg. to 90deg.

From the above it is obvious that unless certain conditions are present, seeds will not grow. One may materially assist germination by a close study and adherence to the conditions demanded for the successful raising of seeds. Material help can be given by preparing seed beds, by watering, by protection, and general attention, but there are other means of assisting germination when seeds will not respond to the usual treatment. The seeds with hard shells take a considerable time for the moisture to penetrate the hard coat. Germination can be hastened by steeping the seeds in luke warm water from twelve to twenty-four hours, or even longer, until the seeds have swollen up. Another method is the clipping of a portion of the hard coat to allow

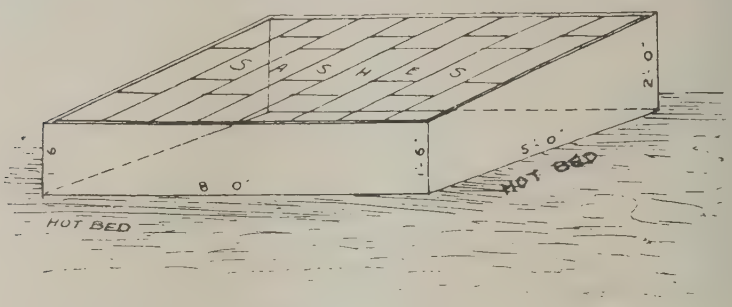
the moisture access to the inner portion of the seed. This can be done with a sharp knife, cutting away a very small part of the shell, and taking care not to injure the interior of the seed. A file will answer the same purpose as a knife. This method of cutting is only for small quantities, and is useful to the amateur, but is not practicable on large plantings. Some field seeds are run through a machine for the purpose of cutting or scarring the outer surface of hard seeds, and is known as "scarifying." It results in quicker and more complete germination if it is done just before the seed is sown. After seeds have once absorbed moisture, they must not be allowed to dry out again under any circumstances. When planting swollen seeds, press lightly into the soil to avoid crushing the life germ.

Another important point with seed germination is the depth at which seeds should be planted. In moist soils small seeds should be pressed into the soil and barely covered with light soil. The general rule is to plant seeds at a depth equal to three times their diameter. This rule is always dependent on the texture of the soil and the moisture existing. Another factor determining the depth is the weather conditions. In light friable soils seeds can be planted deeper than in heavy sticky soils. Plant deeper in warm dry weather than during cold wet weather. During winter shallow planting must be resorted to, and in the summer make sure you have planted deep enough to allow of moisture action on the seed. *The character of the plant* is also important. Beans, etc., and similar seed which push through the soil in a hook-like fashion must have loose soil and be planted shallow. The cotyledons or seed leaves, because of their very tender nature, must not be obstructed in any way, or else the stalk of the young seedling will snap or break off in its efforts to come to the surface. Corn with its spear-like shoots could be planted deeper and would push through more easily even if the soil was somewhat of a heavy nature. Corn can force its way up from a surprising depth, whereas beans should not be placed deeper than three inches, or they may not come up at all. *The time to sow* depends on the season and the class of seed to be planted.

Soft leafed vegetables such as French beans, cucumbers, pumpkins, etc., should not be planted in the open until all danger from frost is over and the atmospheric conditions are warm. The seeds of these plants will not germinate unless the requisite amount of warmth is available. Seeds such as turnips, cabbage, etc., can be planted in the open during the winter months. For the raising of early plants of tomatoes, etc., the following suggestions will be found helpful:—

The seed should be sown in boxes prepared as follows:—Take a kerosene case, and, placing it on its narrow side cut it into three lengthwise. This will make three boxes about four inches deep; the centre one will require a bottom. In the bottom of each bore several holes and place therein about half an inch of finely ground charcoal for drainage. Place on the charcoal about three inches of finely prepared soil made rich by the application of either artificial or farmyard manure, but care must be taken not to put too much artificial manure with the soil intended for seed boxes. Smooth the surface and sow the seed thickly enough to raise about 500 plants per box. Press the seed firmly into the soil and water well with a fine spray and cover with a light soil—sand preferred. Plants for the first crop are best raised with the aid of artificial heat. A very successful and most economical way of producing this is by the use of fresh farmyard manure thrown into a heap and mixed with its own volume of straw or fern.

Mix the two thoroughly, allowing the heap to remain for several days until a good heat has developed. Form the material into a heap three feet high, and on this place a frame made as follows:—



Hot-bed and glass frame.

Take sufficient light planking and make a box frame about eight feet long by five feet wide, or in that proportion. Make the rear of the frame about two feet six inches high, the front (which must be facing the morning sun) about 18 inches high. Place the frame on the compost heap, and, if possible, cover the top with glass sashes. If glass is not obtainable hessian may be used. The compost heap should be about 12 inches to 18 inches wider all round than the frame. The seed boxes should then be placed inside the frame or hotbed. The heat of the hotbed must be carefully regulated. This can be done by allowing air to circulate through the frame. If the air in the frame becomes too hot it will be necessary to raise the sashes two or three inches by placing a block at the bottom end. If the heat is found to be too great after lifting the sashes a little, raise the sashes higher. It is advisable to throw hessian over the glass frame at night to protect from frost. The hessian cover should be attached to a long roller so that it may be rolled up and down as required.

When the seedlings are about two inches high they should be pricked off into similarly prepared boxes and placed about one and a-half inches apart in each box, or, better still, pricked off into small earthenware pots three inches in diameter. Replace the young plants in the hotbed and water, care being taken that they are not burned by the heat accumulated in the hotbed. If using pots, place half an inch of charcoal in the bottom of each.

RAISING SEEDLINGS FOR TRANSPLANTING.

(Cabbage, Cauliflowers, Tomatoes, Onions, Lettuce, etc.)

Select a well-drained rich soil, work it into a fine tilth, and arrange the beds about two feet six inches wide and of any length, leaving a small track about nine inches wide as a path between. The beds should be higher than the path. Raise the edges of the beds to prevent the water running off while watering. The beds, being narrow, will allow freedom in watering and weeding.

Do not sow the seed too thickly, but thick enough to allow one inch to two inches between each plant. After sowing the seed, cover the beds with a quarter of an inch of light soil, preferably sand, as sand has been found to be best for the germination of seed. Keep the beds free from weeds and water them well, care being taken not to over-water and cause the ground to become water-logged. If the young plants show retarded growth at any stage, water with a solution of sulphate of ammonia (a large handful to four gallons of water), which will revive them.

HANDLE EGGS CAREFULLY.

Rough handling of eggs is sure to cause some deterioration, even if the shells are not broken. It tends to make the yolk and white less firm, and if sufficiently violent will cause broken and loose air cells. If the air cell is enlarged by evaporation, rough handling will cause the two membranes which line the shell to split apart beyond the edges of the cell, thus allowing the air cell to move or shake slightly as the egg is turned from side to side before the candle. If such an egg is then very roughly handled the air cell may become a freely floating bubble due to the rupture of the inner shell membrane, and the keeping quality of the egg is very much reduced.

DRENCHING A PIG.

The task of drenching a pig is one that takes more skill and patience than most men are ever able to acquire. If not too large, the animal may be drenched successfully if special apparatus is provided. A bottle should never be used, as there is too great danger that the animal will break the neck of it and swallow the glass. The bottle containing the drench should be provided with a short piece of hose, which should be fastened securely at the neck; the part of the hose that is to be inserted in the animal's mouth should not be too firm and stiff. The free end of the hose is placed in the animal's mouth, and when it reaches the back of the mouth the animal will usually chew upon it and discontinue squealing; the liquid is then allowed to run into the mouth very slowly. Care should be taken that the liquid does not flow too freely. The danger in drenching is from pneumonia, caused by liquid entering the lungs.

RABBITS.

The Fallacy of Trapping.

C. J. Craig,
Chief Inspector Rabbits.

Repeated investigations have conclusively established the fact that under natural conditions there is at breeding time a superfluity of males which compels the females, in order to escape unwelcome attentions, to depart from the main deep burrows, and seek refuge in a hastily made hole on the surface. Here they are exposed to many dangers from which they would have been free underground, and the result is that their natural enemies take full advantage of the helpless position in which they are placed. It is estimated by competent observers that a male rabbit has the same service capacity as a ram, and that therefore about two bucks to a hundred does represent a sufficiency to ensure a maximum production of young rabbits. The trapper, in his operations, so conducts his operations as to catch a maximum of male rabbits. For a variety of reasons he does not desire females, hence he sets his trap in zones where his experience tells him they are least likely to be found. As a result, the great proportion of rabbits caught by trappers are males. In fact in this matter he cannot help himself no matter how he sets his traps; the male, as in all animals, is the most fearless, and is the first out of the burrow, the first on the runs leading to the feed patches, and naturally is the first to find the trap. By their methods the proportion of them is so regulated in the burrows that ideal opportunities are created for the propagation and spread of the species. In other words, the trapper is an abettor, and not a destroyer, of the rabbit.

Strange as it may appear, one frequently hears the argument that the rabbit industry is a very great boon to Australia; why should any attempts be made to eradicate them? Surely, they say, when hundreds of people are doing so well, you do not want to close this avenue of wealth. This question, like every other, has two sides; and it is only by considering it all-round that we can arrive at a right conclusion. Admitting that some thousands of pounds are gained every year by those who engage in the frozen rabbit and rabbit skin trade, yet we have also to estimate the loss, and who can rightly do this? What has been the cost to land owners for poison carts and other means of destruction employed? Consider what enormous sums have been spent in wire netting in endeavouring to check the ravages of the pest. Out of this, who can tell the depreciation in land values as a direct result of the rabbit invasion? If it were possible in any way to place columns of figures in comparison, the result would certainly surprise the whole community. Australian wool and wheat have long held a prominent position in the world's markets, but if bunny once gets the upper hand, it would be ruinous to those staple products. At best, the demand for frozen rabbits is limited; how easy it would be to glut the market, and this is also true of the fur trade.

In 1892 New South Wales carried just on 63,000,000 sheep, nearly all merinos, and the State was not overstocked, as about one-third of its area was carrying no stock for want of water. Since that date millions of pounds

have been spent on artesian bores and other water improvements, and the whole area has been occupied and stocked, with the result that it now carries about 33,000,000 sheep, about 25,000,000 of which are merinos. This 60 per cent. fall in the number of merino sheep partly accounts for the abnormal price that merino wool is bringing to-day. This colossal loss is due to the rabbit pest and the blowfly pest, the latter being most destructive to merino sheep.

Mr. Frank Mack, of Narromine, estimates the loss by rabbits to New South Wales since 1888, when they first came in from Victoria, at £200,000,000. To-day it is much less profitable, on account of the pests, to grow merino wool as 3s. per lb. than it was 30 years ago at from 10d. to 1s. per lb.

Trapping is only advocated by those who have very little knowledge of rabbits. The Vermin Departments in all the Eastern States, after years of experience, agree that it is not only non-effective, but harmful. Trapping the rabbit is similar in result to the pruning of a fruit tree—eventually increases production. One morning's work with the fumigators now available would, especially in the winter months, be more effective than months of trapping.

Farmers in the Eastern States are against trapping.

Queensland.—Gregory North and Darling Downs Conference, 1916. Extract from report:—"We find that trapping is not effective as a means of destruction."

New South Wales.—Pastoralists' Conference held at Hay, November, 1922: "We are strongly of opinion that the professional trapper should not be encouraged, and that all members be circularised to this end."

Victoria.—The South Gippsland Farmers' and Graziers' Association annual meeting held October, 1922, *carried*: "That the Vermin Destruction Department be requested to prevent any trapping being done in the association's territory."

South Australia.—Extract from evidence given by Mr. John F. Cunningham, pastoral inspector for Messrs Dalgety & Company, at conference held 28th November, 1916: "Trapping does not keep the pest down. If you trap, the rabbit increases."

SOME STRIKING FACTS.

There are some very striking facts that justify this statement. Wherever the sexes of rabbits secured by trappers are investigated, it is found that from 80 to 90 per cent. are males; conversely, where poisoning operations are effectively carried out on land that has recently been trapped, the poisoned rabbits are nearly all does.

Some years ago the Victorian Vermin Destruction Department took in hand the poisoning of rabbits on Restdown Estate, near Rochester. The men employed in the work took possession of the ground just as some skilled trappers left it. The general verdict in the district was that the latter had left no rabbits behind them. Poison was laid, and in the presence of witnesses the departmental inspector gathered 2,996 rabbits, of which, on examination, only 22 were found to be males. Poisoning operations on recently

trapped country at Allanbee led to the destruction of 995 adult rabbits, out of which 895 were females. In the early part of this year, of 7,000 rabbits poisoned in the Daylesford district, 85 per cent. were females.

Within a 10-mile radius of Lancefield Junction, in territory that had been heavily trapped, 100,000 rabbits were recently killed by poisoning, of which 85 per cent. were females.

AN EFFECTIVE MEANS OF EXTIRPATION.

There are plenty of other instances showing both the efficacy of the departmental methods and the very high percentage of females that are destroyed by such means. If poisoning and fumigating on these lines are adopted during the breeding months, which range from June to October, the destruction of each female practically means the destruction of 25 descendants, which figure represents the average reproductive capacities of a doe in the course of a year. This fact establishes the importance of winter fumigating,

Showing results of Fumigation.

Cyanide Fumes rising from Warren.

and also explains why the rabbit trapper, so far as possible, avoids catching female rabbits. The following interesting episode in the recent history of a trapper in our wheat belt carries its own moral. With the proceeds of money earned by trapping, he acquired a property adjoining that on which he had previously pursued his calling. He was asked if he was going to clear it by trapping. Somewhat to the indignation of local land owners, to whom he had always before extolled the merits of trapping, he made the following significant reply: "If you men were foolish enough to grow rabbits to provide me with funds to take a farm, I am not foolish enough to let anyone else come the same game with me. I am going to poison and fumigate it, and when I can afford it, wire net."

WOOLLY APHIS PARASITE (APHELINUS MALI).

L. J. Newman,
Economic Entomologist.

There are encouraging indications that this little internal parasite has taken an effective hold in several districts. It is a little over 12 months since we received our first consignment from New Zealand. We have, however, succeeded in establishing the wasp in several good apple centres, and look forward with confidence to great good resulting from its introduction.

Dr. Tillyard, of New Zealand, reporting recently on the work of this parasite in the Dominion makes the following statement:—"It is a memorable fact, that after only three years from the date of the introduction of Aphelinus, the parasite has succeeded in practically eliminating the Woolly Aphis from large areas of orchard country in New Zealand. The unexpected and almost phenomenal success recorded from all parts of the country, is due to several causes, but in the main to the fact that the strain of Aphelinus which is being propagated is expectionally vigorous, owing to its being a cross between varieties taken from three widely separated parts of the United States."

Having established this same strain locally, there appears to be no reason why we should not get equally effective results here in the West as in New Zealand. The host aphis flourishes under local conditions, so that a shortage of natural food supply cannot be possibly advanced as a reason for failure, should the experiment so prove to be. Many people are very impatient in regard to the work of an introduced parasite. They expect to see almost at once, a magic reduction of the pest. The fact that the aphis is present in millions in an orchard before the few hundred parasites are introduced, and the continued increase of the pest is rapidly taking place must not be forgotten by such persons. It takes some considerable time for the parasite to accommodate itself to the new climatic and other conditions. It then has to commence reproduction sufficiently fast to overtake the huge lead which its host has on it. The New Zealand growers are satisfied with the results, not of one year, but of three years. The fact that we were able to successfully establish this beneficial parasite with one introduction, I consider an excellent omen of its future possibilities as a controlling factor of the most dreaded apple pest existing within our State. The establishment of this parasite may mean the saving of many thousands of pounds spent at present in necessary spraying, and is therefore of great economic importance.

During the first year of distribution we were enabled to forward to applicants 120 colonies. The parasite was distributed per medium of twigs carrying parasitised Woolly Aphis. This method entailed the cutting of much wood from the trees supplying the twigs and cannot be continued, as the source of supply will not stand it. It will therefore be necessary for this office to collect the material and breed out the parasite, which will be sent out in tubes. The Department desire that the tubes be returned. Each colony supplied will be accompanied by instructions.

Growers who have the parasite established in their orchards can largely assist the Department in the spread and dissemination of this beneficial insect by permitting their neighbours to obtain cuttings carrying parasitised aphis. The long distances over which the parasite has to be sent makes it difficult to get to its destination alive. If, therefore, some grower in the district has it established, it is comparatively easy to transfer the parasite, per medium of cuttings, from orchard to orchard. Successful introduction is more likely

to follow this method, than by forwarding the wasp in tubes all the way from Perth. The presence of the parasite can be readily determined by a careful examination of the aphis. If upon such examination you find the dead swollen dark bodies of the aphis, devoid of the natural woolly covering, you can decide that the parasite is at work. Later these swollen bodies will be seen to have a hole in them. This is made by the escaping adult wasp, after having completely demolished her host and used the skin of same to pupate in. Such material containing these swollen bodies should be selected for transference of the parasite to another part of the orchard or to some neighbouring orchard. It is surprising how the efficiency of a parasite and its rapid distribution can be increased by its artificial transfer from tree to tree or orchard to orchard. By the growers assisting each other in this manner much labour, time, and inconvenience will be saved both themselves and the Department.

The Entomological Branch has a large number of applications for this parasite, and would therefore be glad to hear from any orchardists having the parasite established and who would be willing to supply cuttings carrying same. With a view to assisting this plan of distribution, a list of orchardists already supplied with the parasite is appended.

Having heard of the successful establishment of Aphelinus mali in this State, we have just received applications from the States of Victoria and Tasmania for colonies. We have had the pleasure of forwarding the material requested, and hope that success will follow.

The undermentioned are growers to whom the parasite has been supplied:—Price, T., "Illawarra Orchard," Karragullen; Enwright, G., Mount Barker; Willmott, F. E. S., Bridgetown; Booth, A. T., Mount Barker; Martin, J., Mount Barker; Omrah Orchard, Mount Barker; Thomas, E., Carbarup; Simmons, J., Denmark; Hill, L., Kalgan River; Ottaway, K., Bedfordale; Howatson, L. B., Bedfordale; Markham, A. J., Harvey; Fields, P. J., Coolup; Mann, J. H., Coolup; Watson, E., Mundaring; Seymour, C. G., Busselton; Ottaway, K. A., Bedfordale; Thorp, A., Donnybrook; Cross, B., Bedfordale; Lowe, A. S., Bridgetown; Richardson Bros., Wooroloo; Hill, E., Bridgetown; Davern, T., Lowden; Watson, H. G., Argyle; Dempster, W., Argyle; Williams, T., Carbarup; Skinner, J., Carbarup; Sounness & Sons, Mount Barker; Sparks, O., Bridgetown; Cullen, A., Bridgetown; Stephens, E. F., Wooroloo; George, W. J., Brunswick; Jones, T., Mumballup; Eccleston, E., Boyanup; Arkle, A., Bridgetown; Parke, G., Donnybrook; Simpson, G., Karragullen; Cosgrove, G., Parkerville; Robinson, H., Wooroloo; Walker, J. K., Duranillin; Messrs. Braddock & Young, Bridgetown; Dickson, G. A. & Son., Boyup Brook; Stark, J. B., Boyup Brook; Faulkner, J., Kalamunda; Grasby, W. C., East Guildford; Perkins, L. S., Tenterden; Hayward, G., Albany; Pearse, W., Sawyers' Valley; Scott, W., Mount Barker; Lang, J., Capel; Joel, Drs. S. & Sons, Dardanup; Wrench, F. M., Bridgetown; Ozanne, C. H., Bridgetown; Buckeridge & Davies, Torbay; Warburton, Edward, Mount Barker; Foley, W. E., Upper Blackwood; Gray, S., Warren River; Egan, A. J., Bedfordale; Skewes, N. L., Bedfordale; Nelson, F. O., Balingup; Spencer, H. E., Bulading Siding; McRae, J., Kalamunda; Stark, F., Kalamunda; Blakers, C., Manjimup; Davies, George, Capel; Patoni, J., Donnybrook; Morris, S. A., Dwellingup; Folland, C. W., Williams; Perkins, S., & Sons, Tenterden; Clontarf Orphanage, Victoria Park; Nicholson, T., Albany; Hubery, F., Bridgetown; Gibbs, P. W., Granite Hills, *via* Kirup; Barnes, F. R., Kelmscott; Calder, W., East Guildford; Gruer, A., Dwellingup; Mr. Owen, Mahogany Creek; Wardell-Johnson, Sawyers' Valley.

CODLIN MOTH (CARPOCAPSA POMONELLA).

Warning.

L. J. Newman, Entomologist.

The State of Western Australia is fortunately free to date of this most destructive pip fruit pest. This fact means much to the local growers and exporters of apples and pears.

There have been several outbreaks of this virile pest in various parts of our South-West. Prompt and effective means were taken each time for the quarantining of the infested areas, with the happy result that each of 12 outbreaks which have occurred have been successfully coped with. The first report of Codlin Moth in Western Australia was recorded in 1902, and was traced to apples smuggled into the State. It is well that all people should know that there is total prohibition of all pip fruits into Western Australia, and that any infringement of this regulation is subject to a severe penalty.

The Codlin Moth is almost as widely distributed around the world as is the apple. I know of no country, other than our own State, which has any area planted to pip fruits and which is an exporter of same that can make the unique claim of freedom from this pest. This fact enables us to export our fruit under a declaration of freedom, and thus enhances its value. The growers are also saved the great expense entailed in other countries of several sprayings for its control.

It is with a view of maintaining this unique freedom from Codlin Moth that I desire in this note to warn the public against a possible recrudescence of this insect. Apple and pear trees blossom during September, October, and November, and if present the moths issue at the same time, depositing their eggs in the calyx of the flower or in the eye of the newly-formed fruit. The young larvæ hatch and burrow their way into the core where they feed upon the pips. In about 30 to 35 days the caterpillar is full grown and leaves the fruit. It then lowers itself to the ground with a thread, and crawls up the tree trunk or under some suitable cover and spins its cocoon. Inside the cocoon it rapidly pupates and reissues as a second generation moth during the first or second week of January.

The larvæ or grub is of a fleshy pink colour, ¾in. long, with 13 well defined body segments or divisions, and a few stiff hairs scattered over its body. The pupa is a reddish brown object ½in. long, enveloped in a white flimsy silken cocoon.

The adult moth is a comparatively small object, about ⅜in. body length, and ¾in. from wing tip to wing tip. The fore wings or front wings in colour are a mixture of grey and brown, the latter predominating. Towards the tip is a darker oval patch, on which are to be seen three golden marks. The hind or posterior wings are of a uniform light brown colour.

The foregoing brief description is given with a view of encouraging all persons to take note of any insect approximating same, and forward at once to the Department for identification. Any caterpillar found invading pip fruits, which it is suspected might be this dreaded pest, should be forwarded at once to the Entomologist of the Department of Agriculture, Perth.

This is the time of the year when we should most carefully scan our orchards and fruit trees for the appearance of Codlin. Once this insect becomes established in our orchard it, like the fruit fly, will be a recurring pest each year, and will mean much loss to the fruit grower and community generally. For a full and complete illustrated account of this moth, with remedial measures, apply to the Department of Agriculture for Bulletin No. 30.

TWO SPECIES OF WILD OATS.

W. M. Carne and C. A. Gardner,

Economic Botanist and Plant Pathologist, and Assistant.

Apart from the cultivated varieties of oats grown in Western Australia, there are two wild species, i.e., species accidently introduced, or, not cultivated. These are the common "Wild" or "Black Oat" (*Avena fatua*) and the "Yatheroo" or "Bearded Oat" (*Avena barbata*). The Black Oat is well known to agriculturists, particularly wheat farmers, as a weed in crops. The Yatheroo Oat, however, is not so widely distributed, nor so widely recognised, except in the Midlands districts, where it is fairly common. It appears to have made its first appearance in the Moora district at the Yatheroo homestead about sixty years ago.

The first specimen of this oat was received by the Department from Harvey in 1916, and since then it has been reported at various places between Newmarracarra (in the Geraldton district) and Harvey, also at various localities along the coastal plain. The species does not, however, appear to have received recognition as a plant of value except in the Midlands districts, in fact it is only during the present year that it has been recognised that it is identical with *Avena barbata*.

The Yatheroo Oat may be said to occur typically on the limestone country between Gingin and Newmarracarra, extending in places to the coast. Here it is usually found as a plant of eighteen inches to two feet in height, sometimes occupying considerable areas available for fodder. In the northern portions of this area it is found often on the hills, whether limestone or broken granites. The settlers of these parts state that it is one, if not the best, of their natural fodders, especially for horses and cattle, which prefer it to ordinary oaten hay.

The species is spreading naturally in these districts, but where it is planted it is frequently not so successful. Left to itself it is found to be spreading over the limestone areas of the Midlands and along the railway line, particularly in well-watered soils.

Where it occurs with Black Oat under similar conditions, it is not as coarse as the latter, being of lower stature with a finer straw, is less hardy, and is not a weed in crops. In some places it is cut for meadow hay. On the poorer soils, where the stand is less dense, or where the soil is better watered, the plants are coarser, and may attain a height of upwards of four feet. In these instances they are not recognised as Yatheroo Oats by many farmers, who are of the opinion that there are several varieties of wild oats, but these cannot be separated botanically from the typical form.

The range of the Yatheroo Oat probably extends as far south as Bunbury. The coarse form is common in the metropolitan area, and the species has been found much further south than Perth. It is not uncommon in the Darling Range, particularly adjacent to railways, along which it is probably spreading. At present we have no record of its having been found

Wild Oats, showing details of spikelets.
Twice natural size.

Yatheroo Oats—Avena Barbata.

east of Chidlow, and it is possible that it spreads much further east, but perhaps in other localities it is confused with the Black Oat. It is hoped that farmers will pay some attention to this useful plant, and extend our present knowledge.

The following are descriptions of the two oats. These, if used in conjunction with the plates should enable readers to descriminate between the two plants.

Wild, or Black Oat (*Avena fatua*).—A plant of two to four feet in height, the stems bearing a loose erect pyramidal panicle of flowers, the branches of which spread horizontally in all directions. Spikelets 2-4-flowered. The husks or flowering glumes are dark brown in colour, and bearded in the lower half with long brownish hairs. At the tips they taper into two short blunt or jagged teeth. The husks are scarcely as long as the outer chaffy scales. The awn or bristle is black and twisted in the lower half, usually 1½ inches long, rarely nearly two inches.

Yatheroo Oat (*Avena barbata*).—Eighteen inches to four feet in height, with stems bearing long one-sided drooping panicles of flowers. Spikelets or heads narrower than in *A. fatua*, 2-3-flowered. Husks or flowering glumes bearded in the lower half with whitish silky hairs, tapering at the tips into two long thread-like bristles, and of about the same length as the outer chaffy glumes. Awn or bristle dark, twisted in the lower half, usually two and a-quarter inches long.

The two plants may be contrasted as follows:—

Black Oat—

Panicle: Spreading with radiating branches.

Husks: Bearded with brown hairs, and rather fat. Shortly toothed at apex.

Yatheroo Oat—

Panicle: Lax, one-sided and drooping.

Husks: Bearded with whitish hairs and slender. With long thread-like teeth at the apex.

THE FEEDING OF SILAGE.

G. K. Baron-Hay, B.Sc., Agric.,
Agricultural Adviser, Dairy Branch.

The silo and its product is fast becoming a fixed factor in West Australian agriculture, and as Henry states, "it has practically revolutionised the feeding of dairy cattle over a large part of the United States" and Canada, so it is believed silage is destined to play fully as important a rôle in local stock feeding practices. A number of silos, both of the overhead and of the trench or pit type, have been filled with silage during the last few months in this State, and information as to methods of feeding silage, and the experience of those farmers who have been using silage for some years will prove valuable.

The Nature of Silage.

The writer has noticed, while travelling throughout the State, that there is a tendency among farmers to over-rate the value of silage in a ration, in fact to regard silage as a complete ration in itself, and the possession of which will solve all feeding difficulties. The composition of silage made from different crops varies considerably, and the nature of the crop ensiled should be taken into account when preparing a ration for milking-cattle or other stock.

The following table gives average results of analyses* of silage made from the crops in common use in this State. The amounts of digestible nutrients only are given, the indigestible portions being omitted:—

Composition of Silage from different Crops.

	Total Dry Matter.	Digestible Nutrients in 100 lbs.				Nutritive Ratio.
		Crude Protein.	Carbohydrates.	Fat.	Total.	
Maize	26·3	1·1	15·0	0·7	17·7	15·1
Oats	28·3	1·5	13·8	0·9	17·3	10·5
Oats and Peas ...	27·5	2·8	12·6	1·0	17·6	5·3

Perusing this table it will be seen that the difference between the three samples is mainly in the crude protein or flesh-forming nutrients. An oat and pea silage contains 2½ times as much crude protein as that made from maize, and it is due mainly to this difference, that as good results as might be expected have not been obtained where silage alone has been fed to stock, particularly if made from cereal crops alone and fed to sheep. Silage made from maize or oats alone does not contain enough protein or "flesh-forming" food to form a complete ration, and needs the addition of some concentrate rich in protein to be fed in conjunction with it. A comparison of a standard ration, with a ration of 45 lbs. of cereal silage per day,

* "Feeds and Feeding," Henry.

fed to an 800 lb. cow producing 3 gallons of 4.0 per cent. milk per day shows this clearly.

	Total Dry Matter	Digestible Nutrients in 100 lbs.				Nutritive Ratio.
		Crude Protein.	Carbohydrates.	Fat.	Total.	
Maize Silage, 45 lbs.	11·8	·49	6·75	·31	8·23	15·1
Oats Silage, 45 lbs.	12·7	·67	6·21	·40	7·78	10·5
Standard Ration	25·30	2·32	14·86	·5	18·31	6·8
Deficiency (approx.)	13·18	1·74	8·38	0·15	10·21	...

The comparison shows that, when silage made from cereals only is fed to cattle, the animals would have difficulty in consuming enough to supply the dry matter necessary to maintain health and produce milk, *i.e.,* about 25 lbs., and even then the flesh-forming nutrients would be deficient. Some roughage, therefore, must usually be fed with silage to increase the quantity of dry matter, and also a concentrate rich in protein, to obtain the best results. With silage, however, made from oats and peas, the first table shows that the addition of peas has raised the protein content to the necessary strength, and only some carbonaceous feed need be fed to raise the quantity of carbohydrates and dry matter to the necessary figure. It is for this reason that a mixture of oats and peas is recommended as a suitable crop to grow for silage. Silage, being of a succulent nature, is pre-eminently suited to the feeding of dairy cattle, and its use will largely remain with the dairy farmer, but it is believed, and the experience of the few who have tested silage for sheep in this State has demonstrated, that silage will prove valuable to sheep breeders for feeding ewes with lambs, and in small quantities as a tonic to all sheep.

Quantity to Feed.

For cows in milk the ration, unless green pasture is available, should include 30 to 40 lbs. of silage, which will take the place of the green pasture, keep the bowels normal, the body tissues sappy, and the skin glossy. Ewes with lambs may be regarded as smaller editions of milch cows, and silage performs the same functions in their diet, though sheep will require only from 1 to 3 lbs. of silage daily as a part of their ration.

Method of Feeding.

For milch cattle the silage ration should be fed in troughs, splitting the daily ration into two feeds given during or just after milking. Only as much silage should be given at each meal as the animals will clean up, and in this connection the individual requirements of each animal should be studied. If chaffed silage from a tub silo is used, at least 2 inches per day should be removed from the whole surface of the tub. Taking the average weight of a slab of silage 2 inches deep and 1 square foot in area as 7 lbs., each cow will consume an area of silage equal to about 5 feet daily. The 14 ft. diameter silo, recommended by the Department of Agriculture, will thus hold sufficient silage to feed a minimum of about 9 cows per day, using only 2 inches daily. Unless this depth is removed daily, the silage

near the surface is exposed to the air too long and may become mouldy. With a pit or trench silo no such considerations are necessary, as the silage is cut from a face, starting at one end of the pit and using a hay knife for the purpose.

Feeding to Sheep.

The following hints are founded on the experience of those few farmers who have fed silage to sheep during the past two or three years. When filling the overhead silo for feeding to sheep, the shorter the material can be chaffed the better. Messrs. How Bros., Pingelly, and A. Piesse, Wagin, have noticed that the finer the material the less waste, the sheep eating the short material far more readily and nosing the longer pieces out of the trough on to the ground. Messrs. How Bros. maintain the chaffed material should not exceed ½in. in length.

All sheep are, or should be, growing wool during the whole year, and this work also has to be carried on while rearing a lamb. As wool contains about 16 per cent. nitrogen, the very element in which cereal silage is lacking, it will thus be seen that it is unreasonable to expect sheep to produce milk to rear the lamb, and also grow wool, if fed on cereal silage alone. Some nitrogenous food must be given in addition, such as clover hay, or crushed oats. During the past dry summer some sheep owners, although feeding crushed or whole oats, had considerable mortality among their sheep, which on post mortem was found due to constipation, corresponding to "dry bible" in cattle. Silage in such cases would prove a corrective as well as a food.

It has been found that overcrowding sheep in a paddock to facilitate the feeding of silage is not profitable. This might be expected, as it is necessary for sheep to have some roughage in addition to silage, as in the case of milch cows. The silage should be fed in troughs, starting with a small quantity per sheep and gradually increasing the amount to about 3 lbs. per head as the sheep take to it, which will need a few days. Feed twice a day, or, if only once, give in the evening when less moisture will be lost by evaporation.

Where a pit or trench silo has been used, and the material not chaffed, more care is necessary to obtain satisfactory results. Mr. N. Davis, Gnowangerup, who had three pit silos last season, utilised about 80 tons of silage for feeding his sheep during the last season. It was found that, the silage being long, the sheep did not relish it at first, and, as the silage was lying on the ground in the hot sun, in a few hours the moisture had evaporated, although the green colour and characteristic odour were retained. Mr. Davis found that, by sprinkling molasses on the silage as it was taken from the pit, the sheep ate the material far more readily and wasted less. For the molasses mixture, use about a quart of molasses in a kerosene tin full of water (4 gallons). When fed long, the bulk of the silage feed should be given at night.

Effect on Milk Production.

A considerable amount of work has been carried out in the United States of America to ascertain the comparative value of silage, and similar fodders fed as hay, in the production of milk. Henry concludes that, with silage, about 7.4 per cent. more milk is produced from equal quantities of dry matter fed as silage over that fed in the form of hay, and that better results are obtained by mixing silage with a dry roughage than with feeding silage alone.

While no definite figures can be laid down for this State, it has been noticed in the returns from herds in the Government Herd Testing Scheme that invariably, where silage is fed, there is an immediate and sustained increase in the quantity of milk produced. Not only is production greater but the cost of feeding is reduced also. In the results for the year ending June, 1923, the average cost of feeding per cow, where silage formed the bulk of the ration during the summer months was £12 3s., as against £20 where chaff had to be employed, during these months.

Does Silage taint Milk?

Owing to the peculiar smell of silage it is sometimes feared that the milk and so the cream will be tainted where silage is fed. Where good silage has been fed to cows, even during milking, this fear is not borne out by facts. The odour of silage is very clinging, and care should be taken that the hands be well washed after handling the material and before milking is commenced. In cases where silage has been blamed for tainting milk, this possibly has been a cause of the complaint.

Silage Rations.

The writer has prepared a number of rations for milch cows and sheep, using silage made from maize, oats, and oats and peas mixed, in which silage forms the bulk of the ration. The concentrates used are those usually found on the farm, namely, bran, crushed oats, lucerne hay, and linseed meal. The rations are calculated for a medium sized dairy cow, weighing about 800 lbs. and giving 30 lbs. milk daily, with a 4 per cent. fat test. Where cows are receiving their roughage in the paddock as pasture, the roughage in the ration may be reduced. In no case are these rations to be taken as a hard and fast rule but as a general guide to the feeding of silage.

	Total Dry Matter.	Crude Protein.	Carbohydrates.	Fat.
No. 1.				
45 lbs. Silage (Maize)	11·83	·58	6·75	·31
10 lbs. Oaten Chaff	9·0	·43	4·64	·15
4 lbs. Bran	3·59	·50	1·66	·12
2 lbs. Linseed Meal	1·80	·63	·76	·06
61 lbs. Nutritive Ratio 1 : 7·1	26·22	2·14	13·81	·64
No. 2.				
40 lbs. Silage (Oaten)	11·32	·60	5·52	·36
12 lbs. Wheat Straw (chaffed)	10·99	·09	4·21	·06
4 lbs. Bran	3·59	·50	1·66	·12
2 lbs. Linseed Meal	1·80	·63	·76	·06
58 lbs. Nutritive Ratio 1 : 7·4	27·70	1·82	12·15	·60
No. 3.				
40 lbs. Silage (Oats and Peas)	11·0	1·12	5·04	·40
12 lbs. Oat Straw	10·62	·12	5·11	·11
4 lbs. Bran	3·59	·50	1·66	·12
1 lb. Linseed Meal	·90	·32	·38	·03
57 lbs. Nutritive Ratio 1 : 6·6	26·11	2·06	12·19	·66
No. 4.				
40 lbs. Silage (Maize)	10·52	·44	6·00	·28
10 lbs. Lucerne Hay	9·14	1·06	3·90	·09
5 lbs. Oaten Chaff	4·50	·22	2·32	·08
2 lbs. Linseed Meal	1·80	·63	·76	·06
57 lbs. Nutritive Ratio 1 : 6·0	25·96	2·35	12·98	·51

	Total Dry Matter.	Crude Protein.	Carbohydrates	Fat.
No. 5.				
40 lbs. Silage (Oats and Peas)	11·0	1·12	5·04	·40
12 lbs. Clover Hay	10·52	·95	4·43	·13
5 lbs. Oaten Straw (chaffed)	4·42	·05	2·13	·05
57 lbs. Nutritive Ratio 1: 6·1	25·94	2·12	11·60	·58
No. 6.				
40 lbs. Silage (Oats and Peas)	11·0	1·12	5·04	·40
15 lbs. Wheaten Chaff	13·05	·19	3·70	·19
4 lbs. Bran	3·59	·50	1·66	·12
2 lbs. Linseed Meal	1·80	·63	·76	·06
61 lbs. Nutritive Ratio 1: 5·4	29·44	2·44	11·16	·77
No. 7.				
40 lbs. Silage (Oaten)	11·32	·60	5·52	·36
10 lbs. Oaten Chaff	9·00	·43	4·64	·15
6 lbs. Crushed Oats	5·45	·58	3·12	·23
2 lbs. Linseed Meal	1·80	·64	·76	·06
58 lbs. Nutritive Ratio 1: 7·0	27·57	2·25	14·04	·80

For feeding sheep, in addition to stubble and other dry picking they may be able to find, an allowance of 1 to 4 lbs. of silage per sheep per day, plus ½ to ¾ lb. crushed oats per sheep, is advisable. The silage should be fed only if the material is all eaten by the stock, as, if allowed to become mouldy or stale, it will cause digestive trouble in sheep. Bad silage affects sheep much more readily than it does cattle. When feeding silage, a guiding rule, either with cattle or sheep, is to feed 3 lbs. of silage and 1 lb. of dry roughage per 100 lbs. live weight.

EXPERIMENTS IN LAYING DOWN PASTURE ON SWAMPY AND TIMBERED LAND IN THE ALBANY DISTRICT, WESTERN AUSTRALIA.

A. C. Vaughan,
Orchard Inspector.

Surrounding and quite close to the town of Albany are considerable areas of Crown lands which are still in their natural state, unused and unproductive. This condition obtains to-day because the improvement of similar lands by the usual methods, which were solely manual, has proved too slow and costly to be economical. Believing that such land if laid down to pasture would be well adapted to dairying, a local Land Development Committee was formed in Albany with the object of ascertaining whether, by the aid of machinery, methods cheap enough to be economical could not be devised to clear and put these lands under pasture.

With a view of determining this point the Land Development Committee approached the Government of the day and asked that, as it had already shown its faith in other parts of the State by development work, it should not be less anxious to test the idle lands in the Albany district. The then Premier readily agreed to their request, and operations were started early in 1920. The Government also made available the services of the Irrigation Expert (Mr. A. H. Scott) to supervise the work. This officer, in conjunction with the committee, carried out the development work until June, 1923, when Mr. Scott resigned from the Department, and since then the writer has been in charge and has continued the work.

The idle lands around Albany may be divided into two distinct classes, namely, bottlebrush or treeless country, which in its natural state is more or less waterlogged and requires draining, and forest country carrying stunted Jarrah (*Eucalyptus marginata*), Red Gum (*Eucalyptus calophylla*), and Sheoak (*Casuarina Fraseriana*).

The first type is invariably swampy and requires draining, and in addition is often covered with such a dense mass of scrub as to entail an enormous amount of labour to clear it if this is to be done by hand. The soil varies in character from sand to peat, and sand in some cases is almost pure peat.

A feature of considerable value in connection with this land lies in its retention of moisture through the summer months, and this phase will be more appreciated as the years pass on, as because of this there are already indications that its stock-carrying capacity is of no mean order. One instance in this connection can be given:—Three acres of this land were laid down to pasture some three years ago, and not in what is now known to be the best way, but during the last year three horses were grazed on this land for six months. Because this soil retains moisture throughout the summer months it is valuable for the growth of summer fodder crops, as well as for pasture purposes.

There are three different species of bottlebrush growing on this country —*B. sparsa, B. decussata,* and *B. callistemon speciosus,* the principal one of which being *B. sparsa.* A great deal of trial work was necessary before any satisfactory methods were found, and although there is still a great deal to

Virgin Treeless and Bottle Brush Land.

be learned about the methods of developing this country sufficient is now known for this land to be laid down to pasture more quickly and more cheapily than was the case with the old methods. It is first necessary to break down the scrub with rails or rollers, the weight of these and the power re-

quired depending on the density of the scrub. Ordinary railway rails have been used with considerable success. After having knocked it down, the scrub is left to dry and then burnt. It is important to wait for favourable weather conditions in order to secure a good burn, for this is necessary in order to

Virgin Timber Country—average 200 trees to acre; Blackboys and under-scrub.

permit the plough that follows to do good work. After the burn the ground is then ploughed with a specially constructed disc plough. Owing to the immense mass of tough fibrous roots with which this ground is filled, ploughing is in fact really the most essential part of the clearing, and for this reason

it is necessary that the plough should be extremely strong and fitted with large discs. The plough ued in these trials was specially made by the State Implement Works, and was loaded with such weight as the need of the country demanded. Though this can be done by means of flat bars of iron secured to the body of the plough, it was found to be best done by having weights specially made to fit on the rear wheel. The discs used were 24in. and 28in. in diameter. Four to six horses are required to pull this plough. After being ploughed the ground was levelled off. The rails used for breaking down the scrub were found useful for this purpose. The ground was then reploughed in order to follow up the first work of killing the immense fibrous root system in the soil. Surface drains were then made at suitable intervals after the ground was reploughed. It has been found most satisfactory with the drains as close as seven yards apart. The drains were made with a "Martin" ditcher, after first being ploughed out with a disc plough. Such drains are quickly and cheaply made, and because of their "V" shape can be readily recleaned out with the ditcher when this is required. After draining the ground should be left fallow for a season in order to permit the fibrous material in the soil to decay as much as possible.

Following upon the preparation and draining of the land it was treated with different kinds of lime at the rate of about one ton to the acre. The kinds tried were burnt lime, ground limestone, and that from various lime deposits. Though the soils are sour the beneficial effect of lime has not been pronounced, and now that certain plants—Drooping Flowered Clover and Lotus Major in particular—have proved their remarkable adaptability to the conditions which obtain in this district the need for an application of lime is somewhat doubtful.

Just before seeding the land was firmed by rolling. This was also done after seeding. The seed was sown mainly in March and April, and experience has shown that if early germination can be obtained the young plants make sufficient growth to stand the cold and wet winter months. Early sowing has proved so decidedly advantageous that it is emphatically recommended.

The most success has been obtained as the result of sowing the seed with an ordinary grain and fertiliser drill rather than by broadcasting. The procedure adopted has been to weigh the quantity of seed necessary and thoroughly mix this with the fertiliser, and sow the mixture through the fertiliser section of the drill.

Under such conditions fine seeds, such as White Dutch Clover and Lotus Major, have been very well distributed and have germinated well, and the success with the drill sowing in comparison with the broadcasting has been very marked.

As has already been stated, this country retains a certain amount of moisture right throughout the summer, but as the grass seed requires to be sown near the surface in the early autumn some rain is required before germination can be obtained.

Various classes of manures have been used, including superphosphate, basic phosphate, basic slag, guano, bonedust, and bone fertiliser. Of these, superphosphate and basic superphosphate have proved most satisfactory, and when the plan of mixing the seeds with the fertiliser is adopted basic superphosphate has been found the most suitable carrier for the seed.

The following clovers have been tried:—Cow Grass (*Trifolium pratense*), White Dutch Clover (*T. repens*), Loftus Major, Drooping Flowered Clover (*T. cernuum*), Strawberry Clover (*T. fragiferum*), Cluster Clover (*T. glomeratum*), Burr Trefoil (*Medicago denticulata*), and Subterranean Clover (*T. subterraneum*). Mose of these showed considerable promise, but Drooping Flowered Clover (known also as Japan Clover and Gingin Clover) and Lotus Major stand out prominently as being the most suitable for the conditions prevailing on these soils. These two thrive where other plants only exist, and are believed to be the most valuable legumes for the conditions obtaining in the Albany district.

The grasses tried have been Rye Grass, Cocksfoot (*Dactylis glomerata*), Paspalum Dilatatum, Sweet Vernal (*Anthoxanthum odoratum*) and Florin. Yorkshire Fog (*Holcus lanatus*) was introduced accidently with some other seeds, and has proved a great success on this type of soil. With Drooping Flowered Clover it is believed to be a very useful mixture as a first crop for the type of soil being dealt with. A small area of this type of country, not of the best type, planted with a mixture of Couch, Drooping Flowered Clover, and Yorkshire Fog carried a large beast to the acre for six months.

The writer is convinced, even with the limited information now gained, that the best types of this treeless country can be made valuable for grazing purposes. Summarising, the treatment which it should receive is, as follows:—

1. The scrub should be broken down by rails and rollers, and left to dry so that a good burn can be obtained.
2. It should be ploughed and cross-ploughed with a heavy disc plough.
3. Surface drains should be made by means of the disc plough and ditcher.
4. The ground should be left fallow for at least a season.
5. The ground should then be reploughed and cultivated before seeding.
6. Suitable manures must be used, and these should include the more soluble forms of phosphoric acid.
7. Drooping Flowered Clover and Lotus Major are recommended as the most suitable legumes, and Yorkshire Fog and Sweet Vernal for grasses.

Having achieved success with the first trial on the bottlebrush country, it was decided to ascertain if similar encouraging results could be obtained in connection with the clearing of the timbered country and laying it down to pasture. The soil of this timbered country is of two types, namely, deep sandy land and gravelly loam on which Jarrah (*Eucalyptus marginata*) and Sheoak (*Casuarina fraserina*) with a sprinkling of Red Gum (*E. calophylla*) are found. The Sheoak, which is a very valuable timber for furniture, etc., had been cut over, and the growth still remaining is of little commercial value except for firewood. Intermixed amongst the timber are blackboys and scrubby undergrowth.

As quick results were desired it was decided to deal with the green timber rather than ringbark same prior to clearing it. The plan decided upon was to first cut out the blackboys and scrub, and then to pull the standing

trees except the largest, which ranged from 2 to 2½ feet in diameter. It was found that there were 15 to 20 trees of this size left after the smaller ones had been pulled.

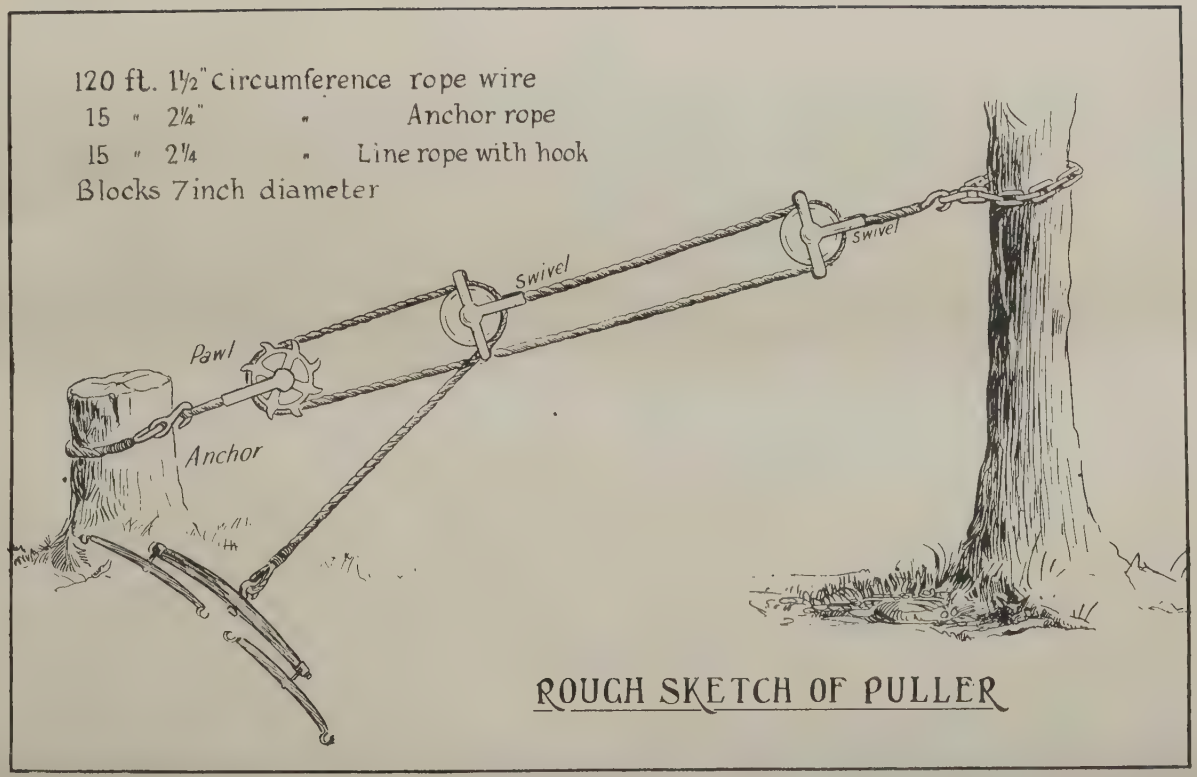
Second Year's Growth of Permanent Pasture, Treeless Country. "Lotus Major," prominent in this illustration, seems to find a natural home in this class of country.

After a good deal of experiment work it was found that the most expeditious method of pulling the trees was by means of an adapted pulley device, as shown in the illustration herewith. This method has been found to be most expeditious, and its work can be carried out best by a gang of three men with two horses. After being pulled, the timber is then left to

dry. At a suitable time a fire is put through the scrub and timber, a good day being chosen when judgment indicates that the timber is dry enough for burning. It is then necessary to cut up the big logs, drag them into heaps with horses, and later burn them.

Treeless and Bottle Brush Country—First ploughing with big plough. Undergrowth should have been knocked down and burnt.

Much of this expensive work could be saved if more deliberate methods were adopted so as to permit the standing trees to be ringbarked in the first instance, kept clear of suckers, allowed to die, and then later the dead timber pulled, instead of pulling the timber when green. It is believed that by this



Showing puller at work.

slower method the cost of clearing can be considerably reduced. Though the timber was pulled in the green stage, satisfactory results have been achieved. The parts that have been cleared have been laid down to pasture.

In view of the fact that in this instance the plough did not have to destroy the large mass of fibrous material in the soil, the preparation of the soil consisted principally in shallow ploughing and cultivating. The land was then treated in a similar manner to the bottlebrush country as far as seeds and manure were concerned.

As on the other soils, superphosphate and basic superphosphate have given splendid results, whilst basic slag has been unsatisfactory.

The results achieved indicate that these lands can be laid down to pasture very satisfactorily and at a considerably less cost than was originally the case, particularly if the land be cleared rather more slowly than has been the case with these experiments, and when the trees are dead instead of in the green stage. Even under these conditions it is anticipated that it can be laid down to pasture within three years. The timbered land is likely to be most suitable for winter grazing, and considerable benefit will result from the provision of deep surface drains.

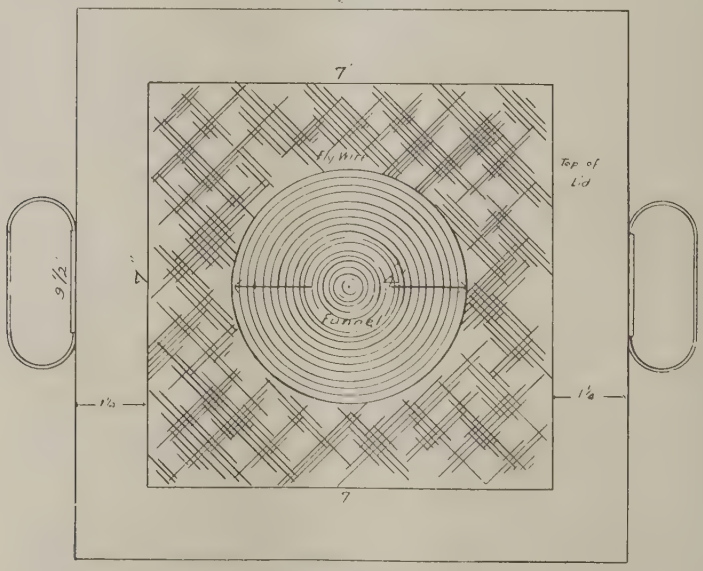
The results obtained with the manures indicates that a generous application of some readily soluble phosphatic manure is advisable. Basic superphosphate was applied at the rate of two to three cwt. per acre, but where this dressing was increased as the result of overlapping, it was noticed that the growth of herbage was much greater.

BLOW-FLY TRAPS.

[Recently a correspondent of the "Journal" at Donnybrook wrote asking for directions how to make a trap for blow-flies. The following note by Mr. J. L. Newman, Economic Entomologist of the Department of Agriculture of Western Australia, gives the information sought and the particulars published here, as they may be of interest and value to many others besides the inquirer.]

Take any kerosene or petrol tin, remove or cut out the top, leaving a marginal edge of about three-quarters of an inch.

In place of the portion removed, solder on a piece of strong fly-wire gauzing, seven inches square, having an inverted funnel let in four inches across the top, gradually narrowing down at a depth of six inches to an opening 5/16th of an inch, or roughly the circumference of a lead pencil. (See illustration)—Top of trap.



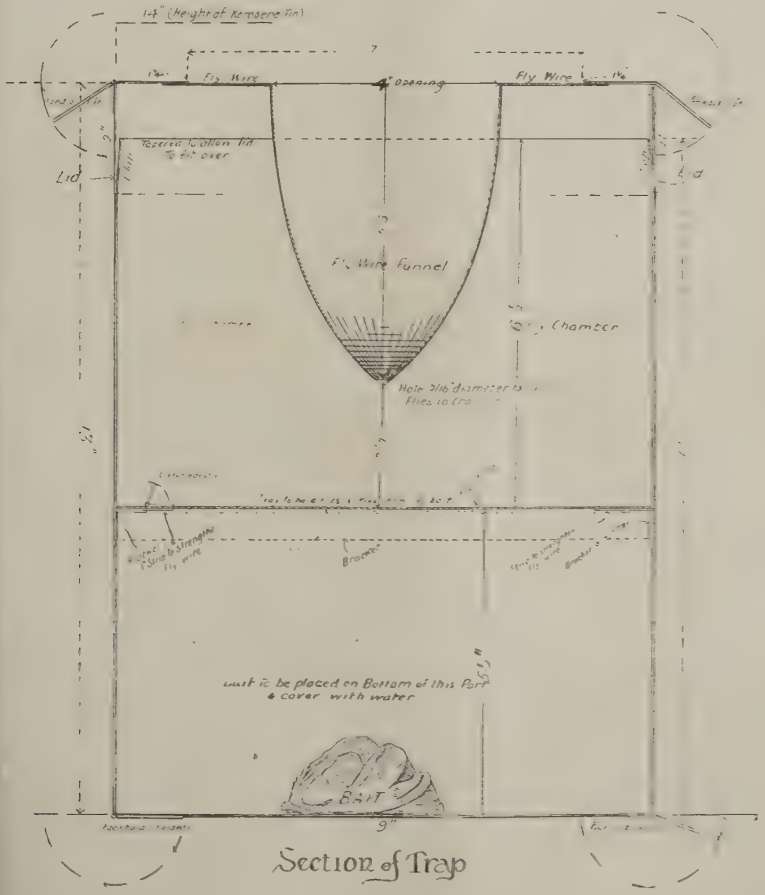
Top View of Lid

When this is accomplished cut off two inches from top of tin all round, thus dividing your tin into two parts: the lid containing the gauze top and funnel and the lower portion, which we call the trap. Slit the corners of the trap one inch, narrow in and solder, thus allowing the lid to slip on.

It will be observed in the plan of trap that a handle is soldered on each side of the trap lid and bottom of trap. This is for convenience in removing the lid. The handles at base of trap are held by the feet whilst the lid is removed, holding the trap between the legs. *Inside trap*, half-way up, brackets may be soldered to support a gauze tray. *The tray* is for the purpose of preventing the flies from reaching the bait, but is not an essential. (See illustration.)

When desirous of re-charging the trap, burn some dry litter over the mouth to kill all the flies before removing the lid.

Bait.—There is no need for a special bait, as any waste meat such as liver, pluck, etc., may be utilised. Place the meat in the bottom of the trap and cover with a quart or more of water. The material will soon set up a fermenting decay, giving forth a strong attractive odour. It is necessary to see that the bait is kept in a moist condition, otherwise it will soon dry up and cease to be attractive. The trap should be placed in a shady position, and tied to a stake about two feet from the ground. If placed in the sun the tin becomes too hot, and the liquid is rapidly evaporated. There is no question that if a number of these inexpensive traps are placed about a property and regularly baited, many millions of blow-flies of all species will be captured. In the use of traps it is essential to maintain farm sanitation, which means the burning of all carcases and other refuse that offers breeding grounds for the blow-flies. The traps are an adjunct to farm sanitation, and do not take its place. It is no use breeding flies simply to trap a proportion of them.



Section of Trap

MERREDIN AND DISTRICT FARM COMPETITION, 1924.

W. P. Cass-Smith, B.Sc.Agric.

This competition was inaugurated in 1923 by the Merredin and District Agricultural Society, and through the generosity of Mr. J. J. S. Cuming, a cup valued at £10 10s. is yearly competed for. The prize is awarded for the "Best Laid Out and Managed Farm" within 25 miles of Merredin, judged on the following point basis:—

Crops and Methods of Farming.

Yield	200
Fallow	100
Rotation	50
Stock other than for locomotion—	
Horses, cattle, sheep, pigs, and poultry	100
Motive power, horses, or tractor	25
Machinery and implements—	
Character	35
Condition	15
Layout of farm and buildings	50
Character of buildings	25
Shelter belts	25
Fences, conditions, etc.	75
Reserves of—	
Water	100
Fodder	75
Home, House Garden, etc.	100
Book-keeping, records, etc.	25
Total	1,000

Judging commenced on the 29th September, 1924, and as the farms of competitors varied in size from 855 acres to 3,400 acres, some difficulty in judging was experienced.

The points allotted for the various sections by the judges, Mr. E. S. Bristow, of Belka, and the writer, are as set out in the table hereunder:—

	J. Lennon	Teasdale Bros.	J. Clothier	H. H. Harling	H. W. Teasdale	J. Kay	H. Birch	Maximum
Yield	145	140	115	145	125	125	115	200
Fallow	95	95	70	90	70	97	80	100
Rotation	50	25	33	45	23	25	38	50
Stock other than for Locomotion	69	43	45	38	37	47	95	100
Motive Power	17	18	15	19	25	75	17	25
Machinery Character	23	25	25	25	30	30	24	35
Condition	7	8	10	8	10	12	10	15
Layout of farm and buildings	45	42	42	38	41	40	41	50
Character of buildings	15	13	12	10	15	14	17	25
Shelter Belts	22	20	23	25	15	12	10	25
Fences, condition	55	50	50	47	40	60	45	75
Water Reserves	69	69	100	67	100	56	26	100
Fodder	38	51	70	7	34	5	18	75
Home, House Garden	83	85	71	85	75	80	86	100
Book-keeping	12	20	5	17	15	15	15	25
Total	745	704	686	666	655	641	637	1,000

The Winning Farms.

From the table above it will be seen that the winner of the competition was Mr. J. Lennon, of "Mallee Mallee," Korbel, whose farm of 855 acres gained 745 points. The layout of the homestead and farm, and the general standard of excellence maintained in all departments were evidence of much labour and careful forethought. A brief talk with Mr. Lennon showed that his work was his hobby, but that he possessed business acumen also, was proved by an examination of his books.

Practically the whole of this farm is first-class land, and when the judges arrived there were:—Crops: wheat, 300 acres; oats, 75 acres; fallow, 333 acres; total, 708 acres. The crops planted on well fallowed land were excellent, uniform throughout, and very free from weeds and disease.

The farm, rectangular in shape, was laid out in large paddocks of uniform size, half being fallow one year and crop the next.

By means of a race down the centre of the farm stock could come from all paddocks to water. Special attention was given to sheep, a flock of the crossbred type being kept, and owing to the prevalence of dingoes they had to be yarded nightly.

The next farm in order of merit was Messrs. Teasdale Bros., gaining 704 points. This farm was 2,650 acres in size, possessed an attractive homestead, and was well laid out. The area under crop was 1,130 acres, and considering the size crops were uniformly good. Up to the present cattle have been used as an adjunct for keeping the fallow clean, but a rabbit and dog-proof fence was in course of erection, and when completed sheep will be bought.

Character of Farming practised.

The character and nature of the farming adopted is shown in the table hereunder:—

Name.	Area in Acres.	District.	Source of Income.	Average area in.			Percentage of Total Area in Cultivation.
				Wheat	Oats.	Fallow.	
H. W. Teasdale ...	3,400 (2,700) cultvd.	Belka ...	Wheat, cattle, and chaff	1,130	350	800	92
J. Clothier ...	1,000	Totadjin	Wheat and cattle	410	70	320	80
Teasdale Bros. ...	2,650	Belka ...	Wheat, cattle, and chaff	960	170	550	63
H. H. Harling ...	1,000	Belka ...	Wheat and chaff	440	...	400	84
J. Lennon ...	855	Korbel	Wheat and sheep	300	75	333	83
H. Birch	1,760	Baandee	Wheat and sheep	670	30	520	69
John Kay	*2,000	Baandee	Wheat, horses, and cattle	600	...	300	60

* 400 to 500 acres salt lake country.

The average area under cultivation for farms 1,000 acres and under was 82 per cent., and for those over 1,000 acres 71 per cent. It would appear thus, that a more intensive system of farming is adopted on the smaller farms.

Fallow.

The fact that the crops which gained the highest points for estimated yield were those grown almost wholly on fallowed land is significant.

The proportion of crop grown on fallow showed great variation, ranging from 100 per cent. on Mr. Lennon's property to 39 per cent. on Mr. Bert Teasdale's, as may be seen from the details hereunder:—

Name of Competitor.	Crop in Acres.	Cropped Fallow.	Percentage of Crop grown on Fallow.
H. W. Teasdale	1,680	650	39
J. Clothier	480	290	60
Teasdale Bros.	1,130	450	40
H. Harling	440	400	90
J. Lennon	375	375	100
H. Birch	700	530	76
J. Kay	600	300	50

In judging the fallow due regard was paid to the freedom from weeds and the character of the soil mulch. The methods of fallowing adopted were generally as follows:—The fallow was ploughed in June and July with Mould Board or Disc ploughs to a depth of three to four inches. In August and September the land was cross-disced after the weeds had had time to germinate.

At the time of our visit to Mr. Clothier's farm the latter operation was in progress, and it was noticed that Stinking Roger had already seeded, and thus one of the great advantages of fallowing, viz., the destruction of weeds, was nullified.

The fallow which gained the highest points was that of Mr. John Kay. The land was very free from weeds and possessed a fine mulch. Mr. J. Lennon's and Messrs. Teasdale Bros. fallow was also in excellent order.

In view of the fact that only two competitors had sheep, it was not surprising to find that in no case was a full three-course rotation being followed.

Whilst it is realised that in the early stages of farming continuous cropping may be a necessity, economically speaking, this method of farming if continued can only end in serious depletion of plant food in the soil.

Although none of the competitors were following a three-course system, they have this end in view. Messrs. Teasdale Bros. and H. W. Teasdale have commenced the erection of a rabbit and dog-proof fence, and on the completion, and with the aid of sheep, this system will gradually be entered on.

For this system of farming where the land after cropping is idle, the maximum economic benefit can only be obtained where sheep are utilised. The advantages of a three-course rotation may briefly be enumerated as follows:—

1. Owing to the longer intervals between the cropping periods the land is given a chance to recover lost fertility.

2. The land becomes enriched with humus, owing to the fact that the stubble is not burnt off.

3. A greater number of sheep per acre can be carried, as the crop residue is utilised for feed.

4.* A saving in nitrogen (one of the chief constituents of plant food) occurs.

5. Weed growth is checked to a great extent, for by grazing the stubble, the are not allowed to run to seed.

6. Liability of crops to fungoid diseases is lessened, as the fungus spore having to remain in the ground without a host for a longer period, may die before the host crop is planted.

Summarised, the main advantages of the three-course rotation are then:—Firstly, the conversion of the stubble into the highly marketable products—wool and mutton; and secondly, a saving in nitrogen, a valuable constituent of plant food.

Manure and Seed.

The application of superphosphate is universal, the rate ranges from 60 to 90 lbs. per acre with a tendency to the higher amount. The chief varieties sown were as follows:—Wheat: Gluyas Early, Merredin, Nabawa, Gresley, Newman's Early. Oats: Burt's Early, Guyra, Ruakura, Lachlan. The rate of seeding is from 45lbs. to 60lbs. per acre.

Owing to the close proximity of the Merredin State Farm to the district in which the competition took place, the advantages of using State Farm pedigree selected seed were generally known and appreciated. The competitors bought a few bags annually, planting the same in small paddocks. The seed from these stud plots was then utilised for the next year's sowing.

Messrs. Teasdale Bros. take a great interest in the work of the Experiment Farm, and guided by Mr. Langfield, the State Farm Manager, have themselves been conducting since 1918 "Variety" and "Rate of Super" trials. The knowledge gained in the light of these experiments greatly assists Messrs. Teasdale Bros. in their cropping.

Weeds and Diseases.

Wild Oats.—This weed was very prevalent on Mr. Bert Teasdale's and Mr. Birch's properties. The former stated that great difficulty has been experienced in its eradication. Here again it is interesting to point out that only 39 per cent. of the crop is grown on fallow. Mr. Teasdale further stated that on fallowed land the weed came up strongly, and, as at present, cattle are his only means of grazing. A great deal of cultivation has to be done to keep it in check. He realises, however, that sheep will play a great part in its destruction, and as before stated, intends keeping them as soon as possible.

Stinking Roger.—This weed was very prevalent throughout the district, but was not regarded as being so troublesome as the Wild Oat. In the early

* Referring to the loss of nitrogen mentioned in (4), it appears from data collected that the aveage proportion of grain to straw in wheat crops is 60.100. Using a seven bag or 21 bushel crop as a basis for calculation, the straw content would be 2,100lbs. The average analysis of the straw is as folllows:—Dry matter, 84 per cent.; nitrogen, .5 per cent. Thus the nitrogen content in the straw from a 21-bushel crop would be 10.5lbs. This quantity of nitrogen in its cheapest form (Sulphate of Ammonia) would be worth approximately 10s. In other words the nitrogen lost by burning the straw from a seven-bag crop of wheat represents a loss of 10s. per acre.

stages of its growth, sheep and cattle eat it readily, and if the fallow is cultivated before it seeds, a great number of plants are destroyed.

Disease.—On the whole, crops were very free from disease. Loose smut was noticed to a minor extent on all properties visited, but as this disease is internal it is not inhibited by pickling. Clean seed is the most effective treatment.

Flag Smut.—On Messrs. Teasdale Bros.' property Flag Smut was noticed on Merredin and Gluyas Early, but not on Nabawa, and as this disease appears to be spreading a word about its control may not be out of place. The greatest danger lies in allowing the soil to become thoroughly infested with the spores of the smut. Rotation of crops is very desirable, as this parasite is not known to attack other hosts. The introduction of an oat crop and a bare fallow period into the rotation is desirable. Early preparation of the seed bed is recommended, because it assists in the conservation of moisture and in the germination of Flag Smut spores before seeding. The opinion that Flag Smut is worse with a dry sowing is generally held, and there is a good deal of experimental evidence to support this. It is of interest to record that Nabawa wheat has not yet been affected by this fungus and is regarded as being strongly resistant.

Takeall.—Patches of Takeall were noticed on Mr. Kay's and Mr. Birch's properties at Baandee, but the areas involved were very small. The remedy for this disease is:—The introduction of an oat crop and bare fallow into the rotation.

Bunt or Stinking Smut.—This disease was not noticed at all, and inquiries revealed the fact that all seed was carefully pickled before seeding. The dry pickling method recommended by the Department is rapidly replacing the older method, and is used by four out of the seven competitors.

Stock other than for Locomotion.

The points awarded in this class were as hereunder:—

	Maximum.	H. W. Teasdale	J. Clothier	Teasdale Bros.	H. Harling	J. Lennon	H. Birch	J. Kay
Sheep	50	...	...	...	...	50	50	...
Cattle, and Breeding horses	30	20	28	28	20	3	25	30
Pigs and Poultry ...	20	17	17	15	18	16	20	15
	100	37	45	43	38	69	95	45

Sheep.—Only two competitors kept sheep, Mr. Lennon's flock being a nice class of crossbred, and Mr. Birch's a Merino flock. The sheep are yarded at night, having access to feed and water. Both competitors realise the value of them in keeping the fallow clean. The value of sheep on the wheat farm is recognised and emphasised by allotting 50 points to that section.

Cattle.—Messrs. Teasdale Bros., H. W. Teasdale, and J. Clothier were using stock to graze down weeds on fallow at the time of our visit, having herds of 47, 50-60, and 57 head respectively. All competitors kept milking cows, being either Jersey, Shorthorn, or grades of the same, and of fair average quality. Messrs. Teasdale Bros. and H. Birch also kept registered bulls of Jersey and Fresian breeds. These were a fine type and well suited for grading up.

Horses.—Brood mares were only kept on three of the farms visited, viz., H. W. Teasdale, Teasdale Bros., and J. Kay. Mr. Kay has developed breeding into an important and profitable department, and in "Koojan Hillside," bred by Padbury and Son, has a fine stamp of sire, whose propotency is indicated by the type of his numerous offspring.

The breeding horses on the two former properties are such that if suitably mated they will provide offspring of good stamp for team works.

Pigs and Poultry.

Pigs.—At the time of our visit few pigs were being kept by competitors, but the quality of those seen was very good. Mr. Birch had some nice young pigs and eight breeding sows and boar. These were all pedigree Berkshire, excellent in type and condition. Good pig pens had also been erected, being solidly built, clean and well drained. Mr. Harling also kept pedigree Berkshires, having eight nice level pigs, and good accommodation for them. The Berkshire breed was favoured by the five competitors who kept pigs, due to the early maturity, fecundity and fine character of the bacon produced by that breed.

Poultry.—All competitors kept poultry, the breeds being chiefly—White Leghorn, Black and White Orpingtons and Rhode Island Red. Mr. Lennon paid a good deal of attention to poultry, 100 head of Rhode Island Red being kept. A fine poultry hut was also noticed, built of stone and erected by the owner. Special precautions were taken to keep this clean and free from tick and Stickfast flea. Mr. Kay had erected a nice breeding pen in which were 60-70 chicks of White and Black Orpington type, looking strong and healthy, and showing evidence of plenty of attention. Some nice turkeys were noticed at Mr. Bert. Teasdale's, and in addition 150 head of poultry. Messrs. Teasdale Bros., and Harling had a fair showing of Black and White Orpingtons and White Leghorns, with good accommodation for them.

Motive Power.

Working horses were of fair average quality on all the farms visited, but special mention must be made of Mr. Kay's and Mr. Bert Teasdale's. The class of horse kept on these farms was well above the average in quality and condition.

A comparison of the work done by horses on the different farms is of interest, and is set out in the following table:—

Name.	Acres under crop.	Cropping, in acres per horse.	Acres under fallow.	Fallowing in acres per horse.	Acres of crop and fallow per horse.
H. W. Teasdale	HP 1,680	52	800	24	76
Teasdale Bros.	HP 1,130	39	550	19	58
H. Birch	F 700	33	520	24	57
J. Lennon	375	27	333	24	51
H. Harling	440	25	400	22	47
J. Kay	600	30	300	15	45
H. Clothier	F 480	27	320	18	45

H.P.—Hart Parr. F—Fordson.

Allowance has been made for tractors by reckoning—

1. Fordson tractor equal to 6 horses.
2. Hart Parr tractor equal to 8 horses.

It is of interest to note that the output in terms of acres of cropping and fallowing per working horse was greatest on the three farms which had the largest acreage under crop and fallow. It by no means follows, however, that though the output per horse is greater the efficiency of the work done is proportional. Messrs H. W. Teasdale, Teasdale Bros., and Birch were all tractor owners, and it would thus appear that on the larger farms, tractors can be used advantageously.

Machinery.

In judging the machinery, due regard was paid to the character and condition of same. Special mention must be made of the machinery on Mr. Kay's and Mr. Bert Teasdale's farms, which was in splendid condition and of good character. All farms had sufficient machinery to meet requirements and the output in this department has been great. "Combine" drills are coming into favour, and the tractor is used to advantage on the larger farms.

Building, Fencing and Layout.

Buildings.—The most important requirement of buildings on a wheat farm may be stated as follows:—

1. Effective stabling of working horses.
2. Efficient arrangement of chaff-cutting plant in regard to stables.
3. Protection for machinery from weather.
4. Provision for catchment of rain water.
5. Small cost and durability.

The buildings of best character were those on Mr. Birch's farm, Baandee. Buildings here were all solidly built and covered with iron roofs. The stable and chaff shed were large, well ventilated and with lighting laid on. Sliding doors were placed at either end, and were large enough to admit of a wagon load of chaff being driven into the building. The stable was so arranged that chaff could be fed direct to the horses from the chaff shed. The implement shed was also of a substantial nature, the uprights being let into cement blocks, the whole providing easy access and good shelter.

The buildings on Mr. H. W. Teasdale's farm were also of excellent character. The 19-stand stable was laid out in an "L" shape with loose boxes at one end. The chaff house and cutting plant arrangement was good, being so placed that both wings of the stable could be fed from it, and a fair amount of chaff stored.

The implement shed was well built with iron roof, being large enough to hold all machinery.

Mr. Lennon's buildings were of fair character, built very economically. The stable and chaff house (built North and South and opening to the East) were adjoining, under an iron roof. The chaff plant was so placed that chaff was fed from the cutter into the store room, which also provided easy access

to the stable. A new feature here was the stone shearing shed with drafting yards adjacent. This building was erected by Mr. Lennon himself. Provision was also made for shelter of implements, and a blacksmith's shop admitted of quick repair of the same.

Good implement sheds were also noticed at Mr. Kay's and Messrs. Teasdale Bros.' properties. The buildings of the former all had lighting laid on, whilst at the latter a useful barn was noticed, good in character and having a large capacity. The stables also were roomy with horse yards adjoining. They were not, however, well sheltered, and the straw roofs, which were in poor condition, were considered dangerous on account of fire. The blacksmith's show was well equipped with all the requisite tools.

Implement sheds on Mr. Clothier's and Mr. Harling's properties were in fair order, and large enough for the purpose. The stable on the former's property was well built but with straw roof. Mr. Harling having just erected a new house on a different site is gradually replacing the old buildings by new ones of a more substantial nature.

Fencing, Layout, and Shelter.

In judging the layout of the farm, attention was paid to the subdivision into paddocks of good shape and equal size, and the accessibility of each paddock to water. When paddocks are of similar size, the area under crop each year is similar under a rotation system.

The best laid out farm was that of Mr. J. Lennon. This property of 855 acres is subdivided into four similar paddocks by a race running down the centre, stock by this means having easy access to water from all paddocks. The fences were sheep-proof of six wires, in good order, both boundary and sub-division. Shelter belts had been left along the edges of each paddock so that, besides providing shelter, reserves of timber are also maintained.

Messrs. Teasdale Bros.' property was of square shape with the homestead centrally situated. The property is at present divided into 14 paddocks, and is so arranged that when future subdivision fences are built, paddocks will be of similar size. From the house a race runs in a northerly direction by means of which stock in any paddock have access to water, either dam or scheme. The fencing is of five plain and barb wire, and a rabbit- and dog-proof fence is being erected.

Messrs. Clothier's and Harling's properties are also laid out in convenient fashion, stock having access to scheme and dam water by means of races. On the latter property the site of the homestead has been changed, and when the old buildings are replaced, the general layout will be good. The fencing on Mr. Kay's property was good, consisting of six plain wires with iron gates. With the exception of this property, few gates were noticed, being replaced by wire stretchers.

Provision for shelter was particularly good on Messrs. Harling's and Clothier's properties. In each case the leaving of shelter belts along the edges of paddocks was favoured rather than having isolated trees.

Reserves of Water and Fodder.

The only competitor who had not the scheme water laid on was H. W. Teasdale. The water conservation on the different farms is shown in Table V. hereunder:—

Name.	Area of holding.	Dam Capacity (Yards).	Dam Capacity per Acre (Yards).
H. W. Teasdale *	2,700 (cleared)	7,025	2·6
J. E. Clothier	1,000	2,300	2·3
Teasdale Bros.	2,650	3,650	1·4
H. H. Harling	1,000	1,300	1·3
J. Lennon	855	1,200	1·4
H. Birch	1,760	...	...
J. Kay	2,000	1,000	·5

* No Scheme Water.

Mr. H. W. Teasdale, who gained highest points for water conservation, has expended a great deal in this branch. Besides the five dams on his property, he also had a well which yielded good water. The dams are well situated to give access from all paddocks to stock, and one of these was covered in, water being pumped from it into a trough by windmill and ball cock apparatus. Except on Messrs. Teasdale's and Clothier's properties dams were not covered in. The loss due to evaporation in open dams is very great, and the question of covering them is well worth consideration.

Reserves of Fodder.

The reserves of fodder, with the exception of Mr. Clothier's, were small when the nature and number of stock to be fed were considered. Mr. Harling informed us that prior to our visit he had sold 100 tons of hay, having seen that the crop in the paddock was assured. This view, however, does not take into account the danger from fire, etc., which exists until the crop is harvested.

Home and House Garden.

The 100 points allotted to the above were divided as under:—

Home	80 points.
House Garden	20 „
Total .. .	100 „

The awards were as followe—

Name.	Home.	Garden.	Total.
Birch, H.	66 ..	20 ..	86
Teasdale Bros. ..	75 ..	10 ..	85
Harling, H. ..	80 ..	5 ..	85
Lennon, J.	63 ..	20 ..	83
Kay, J.	60 ..	20 ..	80
Teasdale, H. W. ..	70 ..	5 ..	75
Clothier, J. E. ..	70 ..	1 ..	71

Mr. Birch's home is snugly situated and has a nice utility and flower garden surrounding it. The house, constructed of pisé bats, has a verandah all round, and has telephone and electric light laid on.

The most substantial home seen was Mr. Harling's. This was built of cement bricks made entirely by the owner.

Messrs. Teasdale Bros. were well off for housing accommodation, having two 5-roomed weatherboard houses, one of which was new and of excellent design.

In addition a man's cottage and single men's quarters were provided.

Mr. Lennon's house had an attractive appearance and was surrounded by a very fine garden, produce from which won prizes at the Merredin Show.

A modern feature here and at Mr. Teasdale's was a wireless set with which market reports were received.

Mr. Kay's garden was particularly fine, indicating much work and care. The home was well situated and had the telephone and lighting laid on.

Cellars for cool storage were noted on several of the farms visited and were a distinct advantage to their owners.

Provision for the catchment of rain water was as follows:—

	Gallons.
H. W. Teasdale	31,000
J. E. Clothier	24,000
H. H. Harling	11,000
Teasdale Bros.	6,000
J. Kay	4,000
Lennon, J.	2,200
Birch, H.	400

Book-keeping.

All the systems examined, with the exception of Mr. Clothier's, were sufficient for the purpose of making up income tax returns, and were simple and efficient, varying only in minor points.

Conclusion.

In conclusion it must be said that the farms examined were a credit to their owners, and to the district.

The spirit of friendly rivalry displayed by the competitors was excellent, and can be productive of nothing but good.

SUBTERRANEAN CLOVER.

A. B. Adams, Dipl. Agric.,
Agricultural Adviser, Dairy Branch.

Subterranean Clover (*Trifolium subterraneum*), so called because it buries much of its seed in the ground, has been cultivated in this State for some ten or twelve years. It has been noted that some varieties have been grown for a longer period –the early variety was growing at Frank's Well, near Wilga, twenty-five years or more ago, and the late flowering variety at Wenigup, near Bridgetown, for over twenty years. It was not until ten or twelve years ago, however, that the now common variety became at all well known, it is now grown extensively, and the area planted annually is increasing by leaps and bounds.

As will be gathered from the foregoing, there are at least three distinct varieties:—

(1) An early variety, flowering at the end of September. Growth long stems with a few small leaves, and the flower has a green calyx. This variety is not of much use in the wetter areas; in the drier districts the later varieties do not mature their seed satisfactorily, and, as the early variety matures its seed while the midseason variety is still in flower, this early kind has possibilities for the drier wheat belt.

(2) A midseason variety, flowering in mid to late October. This variety has shorter sturdier stems than (1) and is much better leafed, and the flower has red markings on the calyx. It is the kind most generally grown, and is greatly increasing the stock carrying capacity of the South-West. The leaves of this and (1) have white markings and often a brown fleck in the leaf.

(3) Late flowering or Wenigup Subterranean Clover. Flowers three weeks to a month later, and grows even larger than (2). It can be readily distinguished from (1) and (2) by the leaves which are green without markings.

Suitable Soils.

Subterranean Clover is adapted to almost all soils except the driest sands and wet swamps. It will stand a lot of wet in the winter if it gets an early start.

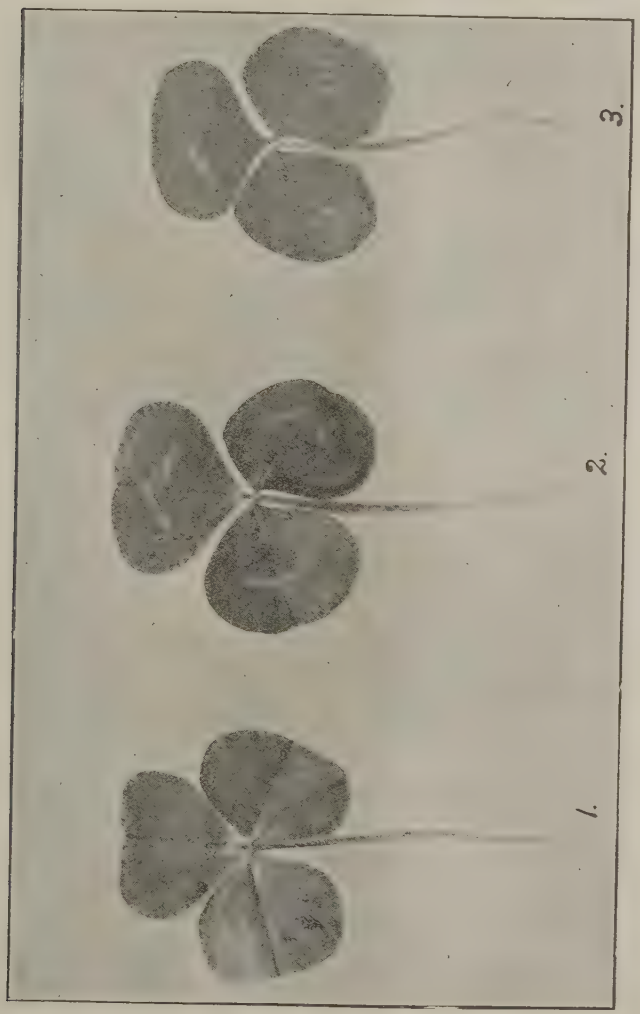
How to establish.

It can be established on—(a) cultivated land, or (b) bush land that has not been ploughed. On cultivated land it is best to sow with a cereal crop, such as Burt's Early oats, sowing the Subterranean Clover seed immediately after the oats have been drilled. The oats may be either fed off or cut for hay. If the clover seed is put through the drill there is danger of burying it too deep to germinate. On bush land it is best sown after the timber has been rung, and for preference after a fire has been through the country.

When to sow.

The time of sowing is extremely important, for, if success is desired, the seed should be on the ground before the first rains in case of sowing on

uncultivated land. On cultivated soil the seed should be sown with, or immediately after, the first rains. The accompanying illustrations of results of early and late sowing will give the reader some idea of the difference that



1. Late flowering or Wenigup Subterranean Clover (no markings on leaf).
2. Mid-season. Common variety.
3. Early flower.

may be expected from different times of sowing. These results might be expected, as naturally the plant matures the seed in early summer, and the seed lies on or in the ground all the summer, germinating with the first rains.

Subterranean Clover. Early planted. Sown about 7th May.

Subterranean Clover. Late planted. Sown about 28th June.

Quantity of seed.

The quantity and best kind of seed to sow is a much debated point among growers. The seed may be—

(a) Clean dressed seed, which should be seed free of husk straw, weed seeds, and other rubbish; or

(b) The seed in the burr raked or swept up from a clover paddock. This consists of seeds of which there are generally two or three in each burr with broken stems and other innocuous rubbish; there also will be other seeds present which may be seeds of other useful clovers and fodder grasses, or may be those of deleterious or noxious weeds, and it is always possible that dodder may be present.

The best kind of seed to sow will depend on circumstances, for the farmer who has Subterranean Clover already growing, the best and cheapest method is to obtain his own seed by sweeping the paddock. It should be stated here that, on an old established paddock, no matter how bare the ground is swept there will be no fear of spoiling the paddock, as the writer has seen a paddock swept as bare as possible, but there was quite a good stand of clover the next season. If the seed has to be purchased, the writer, from personal observation and from discussion with growers, is satisfied that at a reasonable price the clean seed is the best, because it is, or should be, free from weed seeds and there is no excuse for dodder to be present, as dodder has a very much smaller seed than Subterranean Clover, it is easily cleaned out of a sample. In actual germinating power it has been found from experiment by the Government Botanist that clean (de-hulled) seed contains about 20 per cent. of hard shelled seed, and ordinary seed in the burr has about 80 per cent. As an average bag of burr has been found to contain three to four lbs. of seed, though some bags are much lower than this, and some containing little straw go as high as seven or eight lbs.; in practice 1lb. of clean seed will be equal in germinating capacity to an average bag of burr. The advantages of clean seed are that it has—

(1) A higher germinating capacity. Most clover seeds are the better for being scarified, as this scratches the hard coat of the seed and enables it to germinate better, and in going through the dehulling machine much of the Subterranean Clover seed is scarified, and so germinates more readily.

(2) It is much easier to distribute evenly.

(3) If sown on a bush burn, or on hard ground, it is more easily covered and is less liable to get washed into heaps.

(4) Its freedom from dodder and weed seeds.

If sowing on very roughly ploughed or on very open soil the burr is probably the best, as there is a danger of the clean seed being buried too deeply for good germination.

When sowing with an oat or other crop, 1lb. of clean seed or one bag of burr will be ample if sown early. It is not wise to sow through the drill, as the seed may be buried too deep. Many failures are doubtless due too deep sowing. Too thick a sowing is not of much advantage, as what is desired is sufficient plants to produce plenty of seed for the following season,

and with a reasonable germination the above amount of seed will be quite enough. When sowing on a bush burn, or existing pasture, the same amount of seed, 1lb. clean seed or one bag burr, will generally be found quite sufficient.

A settler in the Upper Blackwood states that this season he sowed only about ¼lb. seed per acre over his pastures, and is quite satisfied with the result as the plants are stooling and seeding well. If it is very necessary to feed it off the first season and the land is very good, it will pay to use more seed than the above, but generally, whatever amount of seed is sown, the results are better the second season than the first.

Once this plant is established it will be spread by the stock passing the seed with the droppings, particularly on topdressed pastures; cattle spread it readily, and sheep spread it not only by carrying the seed in the wool, but by passing it in the droppings. Sheep at Noggerup last summer, having the run of a Subterranean Clover paddock and topdressed bush, had carried the Subterranean Clover from the former to the latter, and, as a result, there is quite a useful stand of Subterranean Clover in the bush.

Manuring.

Subterranean Clover responds extremely well to topdressing with phosphatic manures, of which superphosphate and basic superphosphate are recommended. On some soils the difference caused by a light application of superphosphate is remarkable. Whatever the soil, it is advisable to manure at the rate of 1½ to 2 cwt. of superphosphate per acre the first year, topdressing with 1cwt. each season after. On the poorer soils, for the first year's application nitro super. can be substituted for superphosphate with advantage, as the young clover plant is at first dependent on a supply of available nitrogen in the soil—later in common with other legumes it is able to obtain nitrogen from the air.

A supply of locally threshed seed has not been obtainable up to date, but it is hoped that this season a certain amount will be available and that before long, with the more extensive use of de-hulling machines, there will be ample supplies of local seed, and that eventually an export trade will be established. It is impossible to create an export trade with seed in the burr for the obvious reasons that it is too bulky; no country would care to take the risk of introducing weeds and dodder, and the purchaser would be unable to estimate the seed he would get.

Summary.

To establish Subterranean Clover it should be sown early, and should not be grazed heavily if at all the first season. In particular, sheep should be kept off for the first three months. It should be manured with 1½cwt. to 2cwt. of superphosphate or other suitable phosphatic manure the first season, and a consistent topdressing with about 1cwt. per acre each succeeding season will be found highly profitable.

CITRUS DISEASES.

Brown Rot and Leaf Blight.

W. M. Carne,
Botanist and Plant Pathologist.

A rotting of the fruits of oranges and mandarins, the falling of their leaves, and similar troubles with lemons constitute the most important group of diseases of citrus in the field in this State. The attention of this Department was first drawn to these troubles in 1916. In 1917 they were found to be distributed over nearly the whole of the citrus-growing area of the State. During the past three years, however, their importance has become more marked, and growers have become much concerned at their losses from these causes and the lack of an effective control.

BROWN ROT AND LEAF BLIGHT OF ORANGES AND MANDARINS.

Occurrence. As stated before, this disease occurs to a greater or lesser extent in all the citrus-growing areas. It is, however, generally more serious on the Darling Ranges than on the coastal plains. In the former area the first outbreak usually appears soon after the first soaking rains in the autumn. The attacks recur with every wet spell until they reach their maximum about the end of August. With the coming of the dry season they cease. On the coastal plains the damage done before August is usually of little consequence except in a few places, as at Maddington.

Losses.—The losses vary in different orchards and in different seasons. The diseases are not necessarily bad every year in the same orchard. In some cases the loss is practically nothing, whilst in others it may run into hundreds of cases of fruit. Even the same portions of an orchard are not necessarily the most affected each season. In general, however, the trees nearest permanent water, or the best supplied by natural soakage, or on the wettest soils, or on land which has been flooded from a stream, are most affected. Whilst the loss of fruit is the most obvious it may not be the most serious result. Where the leaf attack is heavy the twigs die back, and the affected portions of the trees bear little or no fruit the following season. The direct loss of fruit may exceed 50 per cent. of the crop of badly affected areas.

Varieties attacked.—All varieties of oranges and mandarins grown in the State are attacked. The effects are greatest on the earlier varieties, and especially those which have the fruit in bunches, as in the Common orange. The later varieties suffer less as they colour later, for fruit has never been noticed to be affected when green.

SYMPTOMS.

Brown Rot.—Affected fruits develop a dull, dark, circular mark, usually on one side, which spreads until the whole fruit may be affected. Before this stage is reached the fruit usually falls and is rapidly affected by Blue Mould and other secondary troubles. Fruits which remain on the trees or are placed

in a dry place become dry and dark in colour. Fruits in contact with affected fruits are almost invariably affected also, that is, if one in a bunch is diseased the remainder may be expected to develop Brown Rot. The first fruits to become diseased are usually near to or in contact with the soil. When the disease has become established, however, fruits with Brown Rot may be found at any height on the trees. Affected fruits have a distinctive odour.

Leaf Blight.—Affected leaves develop dark water-soaked patches, usually at the tips, but sometimes on one edge. Within a few days these leaves curl and fall though quite green. The loss of leaves is often overlooked, but a good indication of its importance is to be found in the number to be seen on the ground. Leaf Blight, like Brown Rot, usually commences low on the tree. In badly infected trees the trouble frequently occurs in vertical strips from bottom to top of the trees. These strips may extend to one half of the circumference of the trees and occur principally on the southern sides.

THE CAUSE.

Until recently the cause of the disease was believed to be a fungus known as *Pythiacystis citrophthora.* This parasite is responsible for Lemon Brown Rot in California. It rarely attacks oranges. Investigations, however, made during the past two seasons have demonstrated that the troubles known in this State as Brown Rot and Leaf Blight of oranges and mandarins are both due to quite another fungus. The scientific results of this investigation will be published elsewhere, and it is sufficient to state that the responsible organism is a species of Phytopthora apparently new to science. The incorrect determination in the past of the cause of the trouble has not been confined to this State, as there is reason to believe that the Brown Rot disease found in Victoria and in South Australia is identical with that found here.

PROBABLE LIFE OF THE BROWN ROT ORGANISM.

The fungus remains in the soil during the summer in the form of dormant spores (or fungus seed-bodies), which had been developed in the fallen diseased fruits and leaves. It may possibly also live as a fungus in a saprophytic (non-parasitic) condition. With the saturation of the soil following the first heavy rains in the autumn, the fungus grows to the surface and there produces a crop of a second type of spore. These are blown or splashed on to the lower fruits or leaves by the driving winds which so often accompany rain. Fruits and leaves touching the ground may come in contact with the spores without the need of them being wind blown. In the moisture on the fruits, especially where they touch other fruits or leaves, or in the drops which collect on twigs and the tips or edges of leaves, the spores germinate. Germination is of two types. In one case the spore opens and discharges a number of small spores. These have the power of motion and swim about for awhile and then settle down. Almost immediately a germ tube is developed which penetrates the leaf or fruit and starts a diseased area. In the other case, the swimming spores are not produced, but an infecting germ tube is at once developed. As the spores from the ground are only formed when the soil is wet, and as infection can take place only when the plants are wet, it follows that the occurrence of the disease is closely associated with wet

weather. This is a fact obvious to all who have paid any attention to this disease. Further, as the southern is the shaded side of the trees it is on that side the fruit and leaves remain wet longest, and, as is to be expected, the greatest amount of disease occurs as a rule.

The affected fruits and leaves during wet weather produce spores while on the tree. These are washed down into drops which fall on to lower parts or are flicked by the wind-blown branches to any height on the same or nearby trees. As the winter rain-bearing winds come from the North-West to South-West the disease might be expected to move in a similar direction. This was strikingly illustrated in one orchard in which the disease started on the western side and passed to the east side in an irregular strip. On the fallen fruits and leaves more spores are formed, so that the disease tends to become worse with each wet spell as the season advances. In the tissues of the fallen fruits and leaves resting spores are formed. With the decay of the former these resting spores pass into the soil to carry the disease over to the following autumn.

There is no evidence that the disease spreads from fruit to fruit on the bench or after being packed. In fact, in spite of field indications there is no evidence of spreading by contact. When bunches are affected it is probably by spores in the water which collects where they touch. Affected fruits found in cases are those on which the infection was so slight as to be overlooked when packed. Infection, however, might spread should the cased fruit become wet. There is no evidence that the disease carries over on affected trees from season to season.

TREATMENT.

Experiments carried out during the past season in orchards on the Darling Ranges have indicated that a very effective control may be established by spraying the trees with Bordeaux or Burgundy Mixtures towards the end of April or early in May. The evidence is that this one spraying properly carried out is sufficient, but it may in some cases be necessary to spray a second time should the disease make its appearance.

In June, 1922, a large navel orange tree at Walliston was sprayed by Inspector Read of this Department with Burgundy Mixture. It had been badly affected in 1921. Inspector Read reported that the disease did not appear in 1922 and 1923, and only a slight infection in October of this year. No further sprayings had been applied.

Mr. Oliver Owen, of Pickering Brook, whose orchard had suffered considerably during the previous season, sprayed 15 large navel orange trees with Burgundy Mixture during May of this year. The result has been most outstanding. When inspected in September and October no diseased fruits were found under the sprayed trees, whilst beneath the adjoining rows of similar trees on both sides were large numbers of affected fruits.

Similar results were obtained by spraying with Bordeaux Mixture at Mr. A. C. R. Loaring's orchard at Bickley. The trees were sprayed in April, some all over and some only to the height of about 4ft., as well as on the soil under the trees. The half-sprayed trees gave results almost as good as those sprayed all over. Very little fruit rot or leaf blight developed on the sprayed trees.

Both Mr. Owen and Mr. Loaring are convinced of the excellent results of the spraying and intend treating the whole of their orchards next season. These experiments were carried out in conjunction with Mr. Wickens, Officer-in-Charge of Fruit Industries, Fruit Inspector Read, and myself. The results have convinced us that there is a strong probability that, in spraying with copper fungicides growers have an effective method of controlling the disease. It is to be hoped that all growers with affected orchards will spray their citrus trees during the next autumn, so that the treatment may be tested on a large scale. Spraying only some of the trees is not advised as those unsprayed are liable to act as centres of infection which may produce the disease on parts of the treated trees which are missed by the spray.

The following methods of prevention are strongly recommended to growers during the coming season:—

(1.) Spray all citrus trees (see remarks on Lemon Brown Rot), and the soil underneath them with Bordeaux Mixture, summer strength (4—4—50), or Burgundy Mixture (4—6—50), in the autumn before heavy rains set in. If the disease appears seriously during the season, repeat the spraying during a dry spell.

(2.) Pick up all fallen infected fruit. These should be destroyed by burning, or carted into the bush well away from arable soil or gullies draining into cultivated land.

LEMON BROWN ROT AND LEAF BLIGHT.

These diseases are similar to and usually occur in the same orchards as Orange Brown Rot and Leaf Blight. They are caused by fungi which have not yet been investigated in detail, but which appear to be distinct from, though similar to, that on the oranges. Both troubles may occur together or separately. Leaf defoliation is more general than with Orange Leaf Blight when serious, and is not confined to portions of the trees. In one instance every leaf fell off a number of trees, leaving hanging large crops of sound fruit.

In the earlier stages of attack the lemons develop an odour similar to that of oranges with Brown Rot, but this turns to a distinctly sour smell owing to the almost invariable occurrence of Sour or Greasy Rot. This secondary attack makes the fruits very soft and greasy, so that they collapse into a wet slimy mass.

TREATMENT.

Though not thoroughly investigated the causes of the lemon diseases are undoubtedly fungi of similar character to that causing Orange Brown Rot. Experiments in controlling these lemon diseases have not been undertaken, as until quite recently it was believed that the lemon and orange diseases were similar. Growers are strongly advised to try on their lemons the treatment recommended for the oranges.

A W.A. FARMER'S IMPRESSIONS OF MALAYA.

J. Deane Hammond.

This does not presume to be an account of the Malay States, but purely on the country as seen through a farmer's spectacles. It refers chiefly to products, articles of food, and industry used in our everyday life, but not grown in Australia which at once attract a farmer's interest. The contrast in agricultural problems there and here is marked differences in climate, rainfall, soil, labour and products. With only nine days spent in the Federated Malay States one feels one's observations are strictly limited, but such as they are may be of interest to another farmer who would look at things in a similar manner. There are several Malay States, quite distinct, with different fiscal policies, some directly under British control, and others have a Brit-

In Malaya: A Big Bunch of Bananas.

ish adviser, whose advice is taken without question. The points which impress one more than anything else are the luxuriant perennial growth and the splendid roads everywhere. There are no seasons no summer or winter.

Trees and plants do not die down. The rich soil and heavy rainfall in the tropical climate render the growth such as is hard to realise and quite impossible to describe. There is hardly any variation in temperature from the beginning of the year to the end, night or day, which registers about 80° in the shade, and the heat is humid. The rainfall varies from about 80 inches in the South to 164 inches at Taiping. These points will explain why the journey through these States is so enthralling, why one feels so staggered by the extraordinary growth—one marvellous transformation scene. The other striking observation was the splendid roads wherever you go. One remembers there is cheap labour. There is, too, a heavy rainfall, which makes road construction and maintenance costly: still, everywhere the roads are good, whether near a town or away back in the jungle. One is forced to believe they understand the job of road construction. The total absence of holes, bumps, and dust renders travelling not only for carting produce, but for motoring an intense pleasure. The whole area is, or was, covered by dense jungle, denser than any growth in Australia. To subjugate the jungle, difficulties not only in the growth appear, but dangers through animal life in the jungle, which constrain one to dwell for a moment on this. The fauna is the richest in the world both in number and variety of species, and includes tigers and others of the cat tribe, apes, monkeys, black panthers, bears, elephants, rhinoceros, etc. Bird life is profuse, there being over 600 varieties, and the jungle is alive with reptiles—cobra, python, etc., while the river swamps abound with crocodiles, all of which make an annual toll on human existence. The people of the country, to a visitor, are full of interest. It is densely populated in comparison with our own country. The country would never be developed if left to the Malays, who are lazy and not ambitious, consequently alien races are introduced. The British hold the important positions. The Chinese are the most numerous aliens; then the Indians, chiefly Tamils, are largely employed in agricultural work. The Malay is satisfied to have a few rubber or cocoanut trees on which to eke out an existence.

Agricultural Products. Of the many agricultural products rubber stands out by far the most important. Rubber is a native tree of Brazil. From there seeds were sent to England, and in the "seventies" 22 rubber plants were sent from England to Singapore, and from that small beginning Malaya has become the greatest, almost the sole, rubber producer in the world, there being over two million acres in this product, about equal to our wheat area in Western Australia. The clearing of the jungle for a rubber estate is done generally by Chinese by contract, and, as with farming in Australia, the success or otherwise largely depends on the way the clearing is done. A good estate has been well cleared, whereas others are seen not only with huge stumps about, but even trunks of trees and some undergrowth. The decaying trees attract disease, white ants, etc., which are disseminated among the rubber. In a well attended estate the land is kept as clean as a well conducted orchard in Australia—not a weed. In Malaya this is not easy, for with the rich soil and abundant rainfall the calang grass, a quick-growing grass is difficult to keep under and must be hoed about every three weeks. Estates are not as a rule fenced, and are planted in lines each way 20 feet apart. The tree is a gross feeder. Tamils, who are indentured, mostly do the work on the plantations. Labour is not an easy problem, and requires a good deal of tact as well as firmness on the part of the management. The coolies, often married, are quartered in what is known as "lines." These are a series

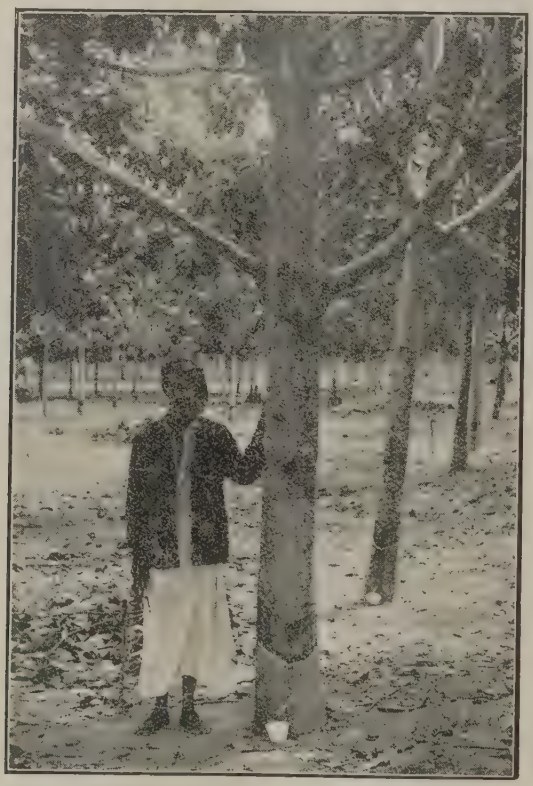
of well constructed cottages of sawn timber with two rooms for each, and carried along a line. These "lines" are parallel, a few chains apart. The rooms are about six feet above the ground, as a protection against tigers and other animals. In addition to supplying rice and other food for the employees, one surprising provision was a temple for their religion. This appears to be essential, as religion forms a large part in their life. An attend-

In Malaya: A Rubber Plantation.

ant gives his time to this and places flowers, etc., in its precincts. Adjoining this is a "theatre," but somewhat different to what whites frequent. When they have a "play" it generally finishes up at daylight.

Rubber trees are ready for yielding returns at seven years, and their life and profit depend on judicious handling, both in the early stage and later. A small cut is made about three feet from the ground in a slanting direction in the outside bark, and a cup is hung on to receive the white fluid like milk, or latex as it is called, which runs slowly from the cut. (The cut is small, as will be shown by the fact that one inch of bark only is cut in about six weeks). Each morning the whole yielding area is tapped, and each coolie visits about 430 trees, emptying the latex from the cups into buckets, and makes another cut, leaving the cup in position. This work must be completed all over the estate by about 9.30 a.m., and the proceeds carried by the same coolie to the factory. The factory is necessarily in a central position to save work, as the estates are large. Those visited varied from 1,000 to 6,000 acres. In the latter case the latex was carried to depots, and thence conveyed to the factory. On arrival at the factory the latex is poured into large receivers, and a definite amount of water added. If the object is to make plain "sheet"—the term used in the trade—acetic acid is added, which coagulates the whole mass; but if crepe is required for white rubber or crepe soles, sod-

ium bisulphide is added to the latex be ore the acetic acid. The mass is taken from the receivers and passed through a series of rollers, under running water, which turn it into a useful condition for handling. In the case of plain "sheet" the rubber is hung on rails to dry in sheds and then passed to the smoke-house, where it remains eight days, and coming from there is graded, and known as "smoked sheet," No. 1, etc. If the latex is turned into crepe, it is only dried, and appears almost white. When perfectly dry the rubber is packed in cases holding about two cwt., each, branded and despatched for export. Owing to the supply being greater than the world's requirements, and to save the industry from being ruined, the British authorities have introduced "restriction" regulations. The position of the trade



In Malaya: Rubber Growing—Tapping the Tree.

is reviewed quarterly, and the restriction fixed. At present a planter can only sell 55 per cent. of his production, and has to adjust the amount of latex received accordingly, say by only tapping trees every other day. There are restriction officers, who see the regulations are strictly adhered to. Owing to this further planting or development is not being proceeded with. To sell

only about half one's production appears serious, but this provision of saving an industry seems more sensible than ruination, and in Australia our thoughts might run in similar lines before we see producers deprived of the results of their labours, or those best able sell their products while others cannot and are ruined. The land generally is held under perpetual lease, on which about 6s. per acre rent is paid. Land adjoining a road bears an additional tax, and all rubber pays an export duty of two cents., or about ½d. per lb. (Rubber is worth about 1s. ½d. per lb., London, or about 45¼ cents, Singapore.)

Rice is an article of food very common here and everywhere, and is largely grown in Malaya, and comes second in the area sown. It forms the main food of the natives, and is exported all over the world. It is either

In Malaya: Preparing for putting in Rice Plants.

planted by small owners or in a community holding, where all work for their common good. The land is ploughed with an old wooden plough drawn by one water buffalo, and driven by reins. But while ploughing this animal seems to regard that his mission in life is to feed on the abundant growth through which he passes, nor does the Malay driver care: for I noticed in one place six ploughs were supposed to be at work but not one was moving—the bullocks were feeding. After ploughing a crude harrow is drawn through. Small lands about a chain square are ridged up and flooded with water (the rice land, or padi fields as they are known, is all low-lying). The land is not fenced or subdivided—tracks like cattle tracks divide the individual properties. Here and there are noticed bright green patches, which are nursery beds, in which the seed has been sown. The young plants are set in lines by hand under water, and the crop matures in about six months. During the growing period the crop is flooded with water all the time. The natives use

crude methods for harvesting and threshing, though in some places the Government has factories for treating the grain. The cocoanut comes next in importance. About a quarter of a million acres are planted. It is largely used by the natives for food in various forms, and the oil pressed from the nut is used for food, toilet, and lamps. Copra is the dried nut, and is exported

In Malaya: Cocoanut Plantation.

largely for making soap, etc. It requires wet land, for preference near the sea. Tapioca is largely grown, and the finished article is prepared from the pulp of the roots of the shrub of this name. Sago, another crop grown, too, is prepared in a similar manner. The country abounds in fruits such as bananas, pineapples, etc., which appear to grow easily everywhere. They are grown not only by natives for food but by the Europeans for their own use.

CULTIVATION OF THE POTATO.

Seed, its Selection and Treatment.

G. N. Lowe,
Senior Potato Inspector.

Before leaving the question of all important seed, it may be well to point out that "seed potatoes" and "potato seed" must not be regarded as synonymous terms. "Seed potatoes" are the tubers themselves which have been (or should have been, perhaps, would be more nearly correct) retained from perfectly true and reliable stocks, the successive crops producing tubers which have been grown specially for the purpose of perpetuating unmixed any particular variety. Unfortunately very often small useless stuff, which it would not pay to market, has the dignified title of "seed potatoes" given it.

Potato seed on the other hand is quite distinct, and is the product of the potato "berry" or "apple" which forms after flowering in a number, though not all varieties. The "berry" is very similar to a small green tomato (which is of the same family as the potato), and the seeds also are almost identical in appearance when dried. About 100-250 seeds are contained in the berry, and probably the same number of varieties might easily arise from the subsequent planting due to inoculation. The breeding and selection of varieties by this means is most interesting work, but is essentially for the experimentalist, who must possess great patience and be satisfied with hundreds of useless varieties being passed out for every one which is worth persevering with. Newer varieties are not so prone to the production of "berries," which habit is generally considered a tendency to reversion to the wild form. Our own so-called "Delaware" is rarely noticed with berries attached, but on the other hand what to the writer's mind is a tendency to "throwback" may be noticed, particularly in winter, planted crops latterly. This, however, takes the form of quite a large percentage of plants occurring in the crop, which are of a more upright habit of growth, of lighter green foliage, which has a distinct crinkle in place of the flat smooth leaf of the plant growers are used to in the "Delaware" as it is termed. This occurrence has caused some perturbation amongst growers of bought seed who at once jumped at the conclusion, and reasonably so, that the seed was mixed and not true to name. It is interesting to record that some Eastern States' seedsmen noticed this "throw-back" in crops resulting from seed exported from this State and christened it "Earliest of All." Later, parcels of this same variety came back to Western Australia as something new. As a matter of fact the variety is not quite so early maturing as "Delaware."

The "Delaware," as it is known to Western Australian growers, is undoubtedly not that, but another American variety named "State of Maine." This confusion in naming arose very simply, and came about in the following manner:—A well-known Harvey grower about 15 years ago imported four white varieties from Sydney, these being "Carmen No. 3," "Green Mountain," "Delaware," and "State of Maine." These were planted in due course, but by digging time the labels had become mixed, and the sequel was much after the lines of "The Bush Christening," when the best yielding variety had to "take its chance" with "Delaware."

FERTILISERS.

The question of fertilising the potato crop is a most important one, and the object of it is to provide in the soil an adequate quantity of all the elements needed by the potato plant, and in an available form to allow of it producing a maximum yield. It is not only necessary to provide the suitable fertiliser to the soil, but to have the soil in such perfect mechanical condition that the plant food may be made available easily and readily to the roots of the plant. In theory, of course, it is only necessary to have an analysis of a soil made to determine what deficiencies should be made up by fertilising to ensure a full crop. In practice, however, this procedure will only give a general idea of what fertilisers are necessary or lacking in the soil, and should be used more as a guide to what is requisite in order to maintain the soil at its maximum fertility. So much is dependent on the soil condition to obtain the full return from fertilisers, and far too often is the fertiliser looked to to rectify neglect and lack of thoroughness in working up the soil.

A 10-ton crop of potatoes removed from the soil approximately: 160lbs. of nitrogen, 160lbs. of potash, 60lbs. of phosphoric acid. These three might be termed the essential elements, though there are a number of others which enter into the composition of the plant and are important in its production, but not to the extent that are nitrogen, potash, and phosphoric acid. These minor necessities are generally present in most soils in sufficient quantity to provide for the needs of the crop in this direction without further addition. Lime, however, may be the possible exception, but it is quite surprising to find how often lime is applied to land with the idea that it is a fertiliser instead of an agent to obtain the right conditions in the soil to make available to the plant the other elements. Lime has very valuable properties in the direction above indicated, but not as a plant food.

The potato plant, including the tubers, is composed of elements drawn from the soil through its root system, and even more largely from the air by its leaf system. The average potato plant is composed somewhat as follows: Carbon (from the air), 45 per cent.; oxygen (from air and water), 42 per cent.; hydrogen (from water), 6.5 per cent.; nitrogen (from soil and air), 1.5 per cent.; potash, phosphates and other minerals (from the soil), 5 per cent.

It will be noticed from this how relatively small a part the soil, the condition of which the grower is responsible for, plays in the business of providing the necessary components to the general make of the plant. This small part is nevertheless of very great importance, so much so that often the result of the crop depends largely on how this part has been carried out. This may be likened to the correct functioning of a small portion of a machine without which very indifferent results or failure may be recorded.

WHAT DO YOU DO WITH YOUR STUBBLE?

J. T. Armstrong, B.Sc.Agr.,
Manager Chapman Experiment Farm.

When this question was asked to farmers of a few years ago, the answer was practically unanimous, "I burn it." If asked to farmers now the same answer is far too frequently received. The wheat grower usually burns his stubble:—

1. Because he has so little land cleared that he has to crop it every year and heavy stubble cannot easily be ploughed in, and even if it is turned in it leaves the seed bed too loose and open for good yields.
2. Because he does not know the value of the stubble when it is ploughed in and incorporated with the soil, and sometimes
3. Because some disease as Takeall was prevalent, and burning helps to destroy the spores. Also a hot stubble fire helps in the eradication of troublesome weeds.

The virgin soils of the Western Australian wheat belt are not very rich in their organic matter content, that is, in the decomposing remains of plants and animals, and if the land is cropped continuously or after fallow, and the stubble of each crop burned, the limited supply of organic matter originally there sooner or later will become exhausted. A plentiful supply of humus or organic matter is advantageous for several reasons:—

1. Humus tends to make a heavy soil lighter, more mellow, and easier to work.
2. Humus binds a sandy soil. These results are noticed in a garden which has been given heavy dressings of stable manure, and stubble after it has been turned in for some time has exactly the same effect.
3. Humus increases the water holding capacity of the soil, and this is a very important feature in the agricultural practice of this State.
4. Humus supplies plant food, both directly and indirectly.

Plants take out of the soil up to five per cent. of their dry weight the various elements necessary for the nutrition, the remaining 95 per cent. they obtain from the atmosphere. A certain percentage of the elements obtained from the soil remain in the straw, in particular the potash salts and the nitrates. If the stubble is burned the nitrates are driven off by the heat and are lost. The potash salts are left with the ashes, but are likely to be blown away. If the stubble had been ploughed in, these constituents would have been available for the next crop.

Plant food is supplied indirectly by the aid of soil bacteria as the result of ploughing in stubble. Some of these micro organisms make use of as food the carbo-hydrates, that is, the starches in the straw, and by their action break down the more insoluble potassic and phosphatic compounds in the soil, and so make them available for plants. Also in the decomposition of

plant and animal remains a certain amount of carbon dioxide is liberated which, when dissolved in the moisture in the soil, forms a weak acid, and this acid forms compounds with the soil minerals which the plant can utilise. Other bacteria draw their food supply from the straw and in turn "fix" the free nitrogen from the air, which cereal plants cannot utilise, and by forming nitrates make this free nitrogen available to plants. The farmer often pays too little attention to this question of soil nitrates, and when his yield begins to fall he generally adds more superphosphate, thereby only increasing the phosphoric acid content of the soil. When yields further decrease he adds still more superphosphate, and not getting the required result he concludes that the present day superphosphate is not nearly so good as it used to be. It was probably not so much a low prosphoric acid content which caused his yield to fall as a low humus content, for this would mean that the soil was deficient in nitrates and without nitrates no plant can develop. If instead of increasing the rate of sowing superphosphate he had left the paddock under stubble and grass for a year or two he would not only have saved money but also built up his land, for when the stubble is fed off nearly all the fertilising constituents are returned to the soil and about half the organic matter. Many farmers imagine that a paddock left under stubble and grass for a year is unprofitable, but this not so. Sheep do well on the stubble for some time after it has been stripped, then with the rains the natural herbage grows and provides more food for the sheep and additional organic matter for the soil. The stock break down any remaining stubble, and it can then easily be turned in in the following year, and the land left under fallow to enable the soil bacteria to break it down chemically as the stock have broken it down physically. Other bacteria then do their part and build up the nitrates which are so essential to the growing crop. A good plan whenever possible is to sow some fodder crop, as oats or lupins, in the stubble to provide more feed for the sheep and a greater bulk of vegetable matter to plough in and so gain a corresponding increase in the nitrogen content of the soil. In the Victoria district, lupins sown in the stubble, either with a drill or broadcast, will certainly repay the cost of sowing them. They are a very valuable summer fodder, and by the aid of the bacteria living in the nodules in their roots they increase the nitrogen content of the soil by the formation of nitrates from the free nitrogen of the atmosphere. This method means at least a three-year rotation, wheat, pasture, fallow.

Summarised, the main reasons why stubble should not be burnt are:—

1. Burning the stubble regularly will ultimately lead to the exhaustion of the humus content of the soil, which will become run down or, as it is commonly stated, the soil will get into "poor heart."
2. The practice wastes plant food, both directly and indirectly.
3. A low humus content lessens the water holding capacity of the soil, and does not assist the development of soil bacteria and the formation of nitrates.

These factors tend to lower crop yields and the stock-carrying capacity of the farm, and to take the farmer away from that goal of all good farmers, viz., increased productivity and reduced costs.

THE WITHERING OF WHEAT EARS.

E. J. Limbourn,
Merredin Experiment Farm.

One of the many causes of low yields from wheat is due to the withering of the upper portion of the ear. This is, in many cases, deemed to be the effect of frost. As, however, it usually only appears in later maturing varieties, or in the very late growth of other varieties, it is easily seen that frost cannot be the cause. That is, only ears which show out late in the season

are likely to be withered. The real trouble appears to be lack of moisture, and careful observation shows that the withering actually occurs before the ear leaves the sheath. If, when withered ears start appearing, an ear is examined just before the sheath opens, it will be found that part of the ear

from the tip downwards is very much paler in colour than the lower portion. The upper portion of the sheath also will be hard and dry. As the ear forces its way from the sheath, the auricle, being also dry and hard, grips the tip so that the ear cannot clear itself naturally. This often causes malformation of the ear, even when the tip is not withered, especially with tip awned or bearded types. In the accompanying photograph I have endeavoured to show the cause and effect of tip withering.

No. 2 shows a withered ear just emerging from the sheath, and it will be noticed where an auricle has gripped the tip (see arrowpoint).

No. 1 is a badly withered ear, the top half being practically destroyed.

No. 3 shows a normal ear just leaving the sheath, and No. 4 the well formed ear resulting from it.

These four ears were all taken from one plant of a variety that did not come into ear until the end of October long after the last frosts had disappeared.

Like most other ills, tip withering can be minimised, if not altogether overcome, by more careful methods of farming. It must be remembered that, in the Eastern Wheat Belt especially, October rains cannot be relied upon. Therefore the continued growing of late maturing varieties is a very risky procedure.

POULTRY NOTES.

R. A. Dusting,
Poultry Adviser.

All chicks hatched for this season should now be well forward; the cockerels separated, and the most forward culls sent to market. Attention should now be devoted to pushing on the pullets, culling out any weaklings or backward birds and placing in small runs, so that they may be fattened off and sold for killing. Chicks that do not thrive are not worth keeping for egg production, as they seldom have enough vigour to produce sufficient eggs to repay for their feed and keep during the period of laying. At present prices of foodstuffs and eggs, a pullet that will not produce over 100 eggs in her first laying season will show a loss of 2s. 6d. to 3s. on cost of feed alone, besides labour of feeding, cleaning and accommodation, taking up space which should be given to birds of better stamina. Any weaklings will also contract disease and vermin first, and act as carriers and breeders of same. Healthy stock coming in contact with such birds will be affected, and an epidemic started which may mean heavy loss. Kill the weaklings and make the first loss the last.

As the pullets grow, divide into smaller numbers and allow as much free range and exercise as possible. Do not hurry them by over-stimulating foods, such as meat or condiments. Allow them to develop fully before starting to lay, as in most cases pullets that lay at an immature age, lay unsaleable eggs during the first months of laying, and the eggs seldom attain the size required to obtain best market rates

If you require cockerels for breeding purposes from your stock for next season, to allow for further culling, select double the number required from the early hatched chicks and give them the best of attention, feeding abundance of green food, dry bone once weekly, and good wholesome grains. Remember that the male bird in the pen is half the flock, and if he is not in vigorous health, well developed, and free from vermin your troubles will come next breeding season, with poor fertility, dead in shell and weak chicks. Pay the greatest attention to the selection of the males that head your breeding pens, and there will be less failures in the hatching season.

January, February, March, and April are months that test the ability of a poultry breeder to the utmost. The weather must be anticipated, and birds fed accordingly. When the indications point to an extremely hot day, feed the morning mash largely with green food, and reduce the quantity of food given by 25 per cent. If meat or meatmeal is in the ration, cut it out on hot mornings. Give best attention to water tins—see they are clean and placed in a cool shady place and filled with pure fresh water twice daily. By taking these precautions and throwing a bucket of water in a cool spot for fowls to dust bath, losses from heat apoplexy can be avoided. If the water is allowed to get tepid the fowls drink an abnormal quantity in an endeavour to quench their thirst. This sets up excessive fermentation and lasts all day and often causes deaths.

Shade must be provided away from houses and nest boxes, as on hot days the fowls will crowd into boxes and corners three and four deep and will suffocate. Any birds overcome with heat should be dipped into bucket of cool water or the tap allowed to run on their heads.

It is during these months that vermin, red mite, tick, lice, and stickfast flea multiply most rapidly, and absolute cleanliness and sanitary conditions are necessary to avoid the houses and yards becoming seriously infested. By removing and destroying droppings daily and the spraying of houses with kerosene emulsion, by painting the perches and crevices with wood-preserving oil, such as Jodelite, Solignum or Preserfer, the vermin cannot breed so rapidly, and can be held in check. A good plan where broody hens are prevalent is to clean out nests at regular intervals, and mix tobacco dust with sand and grass in nest.

At this season of year the blood of young growing stock is liable to become overheated, and if neglected chickenpox, warts, or ovian diphtheria will make its appearance. This disease may appear in three forms—an infection of the lining membranes only, an infection of the comb and wattles, on which appear small yellow warts, or a mixture of both. This disease is the cause of heavy losses to poultry farmers in Western Australia, due in the first place to death of numbers of birds, and secondly, if the attack be mild, to great decrease in egg yields at a time when eggs are realising the best prices. The first symptoms are usually dullness and sneezing with watery eyes; diarrhœa is frequently present; yellow cheesy matter is found in the mouth and larynx or windpipe, closing up the passage and causing suffocation. Eruptions the size of a pinhead to a pea appear on comb or wattles or on eyelids. Affected birds should be isolated in comfortable well-ventilated quarters. Any showing difficulty in breathing should be immediately examined, and any cheesy matter in throat or roof of mouth removed with blunt piece of wood or hairpin, and sore spots touched with tincture of iodine or Condy's crystals. Any warts can be touched lightly with carbolic oil, which dries them up and stops irritation. The flock should be given Epsom salts at rate of 20ozs. per 100 birds twice weekly. For the prevention of the disease I found the following method the most satisfactory. Keep the blood cool by feeding half the morning mash chaffed greenstuff, and give more green after the evening grain. Give Epsom salts at the rate of 1oz. to each gallon of drinking water twice weekly for one month, and sulphur mixed in mash at the rate of 2ozs. for every 100 birds for next month, and then revert to salts again. Keep this up from 1st January until May, occasionally omitting the salts and substituting Douglas mixture one tablespoonful to each quart of drinking water. Give young stock ample room in well ventilated quarters. Cock birds being held over for next season must be fed well. Sulphur in mash once a week greatly assist the moult. These birds must be occasionally treated for vermin.

During February and March is a suitable time to experiment in autumn hatching, but to do this successfully suitable breeders only must be used. As autumn breeding is carried on mostly with a view of rearing killing birds for the spring, when prime table poultry is scarce, any of the heavy breeds such as Wyandottes, Plymouth Rocks, Sussex, or Orpingtons are most suitable. Most of these breeds have periods of broodiness during the summer, and a good plan to select those birds just over the broody spell and mate them to an early hatched cockerel of nine months old. The fertility from this mating is usually strong, and chicks will thrive in the early autumn provided that the accommodation is fresh and clean and new ground is available for the rearing of chicks. (Rearing chicks on stale ground, or amongst older stock, is only courting failure.) The pullets are rarely worth keeping for egg production, but the best could be selected and make good breeders the following season. The cockerels if pushed along realise 10s. to 14s. per pair

in Perth Markets if topped off and sold at 5½ to 7 months old, as they come on to market when prime table birds are scarce. It is not advisable to continue breeding after April, as fertility decreases as season advances, and it is better to clean up incubators and brooders, and have a rest from hatching before the main season of August, September, and October approaches. Hens that are approaching their fourth year should now be sold off unless they are of exceptional value as breeders. On no consideration keep hens through moult that are inclined to run to fat, as they will accumulate more fat during moult and are of little use as breeders until late in spring.

If you have not already erected some single testing pens, now is the time to do it. A commercial poultry farmer who does not use this means of testing his breeding stock is working in the dark and making no advance, and in these days of high cost of poultry feeds, the advanced methods of breeding and selection must be used to attain success and make poultry farming a payable proposition. Twelve pens 2 feet wide and 10 feet long would accommodate 24 birds, 12 laying white eggs and 12 brown eggs. By this means you will probably be able to find six birds of each breed fit for the breeding pen the following season, and by putting a distinguishing mark on their progeny would have enough stock to use only tested birds as breeders, and thus increase the productiveness of the flock.

If you are short of green food, plant lucerne in March. I have found that by trenching the sand 2 feet deep in February and planting lucerne in March, giving it a start by watering, a crop 2 feet high can be cut in October. For winter greens rape can be planted to sweeten up the fowl and chicken runs.

Get the winter quarters ready for the pullets and have them well settled by March, as removing them after they start laying will result in loss of eggs. Do not overstimulate the early pullets at this season of year, as it will force them into a partial or whole moult, with the result that four to six weeks' eggs are lost at the time when they are most valuable.

DISEASES OF POULTRY.

NEW REGULATIONS FOR CONTROLLING STICKFAST FLEA.

The attention of farmers, poultry-breeders and others interested is directed to the following Regulations, which are now in force:—

AT a meeting of the Executive Council held in the Executive Council Chamber, at Perth, this 22nd day of October, 1924, the following Orders in Council were authorised to be issued:—

* * * * * *

The Stock Diseases Act, 1895.

ORDER IN COUNCIL.

WHEREAS by "The Stock Diseases Act, 1895," the Governor is empowered, by Order in Council to be published in the *Government Gazette*, from time to time to make, vary, alter, or revoke such Regulations under the said Act as may be deemed necessary for any of the purposes mentioned in the said Act: Now, therefore, His Excellency the Lieutenant-Governor, by virtue of the powers aforesaid and acting by and with the advice and consent of the Executive Council, doth hereby make the following Regulations:—

1. In these Regulations—
   "Diseased" means infested with or attacked by stickfast fleas.
   "Animal" means any dog.
   "Bird" means any domestic fowl.

2. No person shall—
   (a) offer (either on his own behalf or on behalf of any other person) any diseasesd animal or bird for sale, or procure or permit any such animal or bird to be offered for sale;
   (b) permit or suffer any diseased animal or bird of which he is the owner to go or remain outside the premises of such person.

3. Any inspector may at any time enter upon any premises on which he may know or suspect any diseased animal or bird to be, and may inspect such premises, and may require the occupier of such premises to cleanse such premises and to free any such animal or bird completely from stickfast fleas, and also to do whatever is in the opinion of the inspector necessary to destroy all stickfast fleas on the premises and to prevent or check the spread or propagation of such fleas thereon, and the requisition shall specify the particular steps which the occupier is required to take, and shall fix a time for the commencement and completion thereof.

4. Failure to comply with any such requisition as aforesaid shall be a breach of these Regulations.

5. Without prejudice to any liability incurred for a breach of these Regulations, any inspector may, in case of default in compliance with any such requisition, do or cause to be done all such things as may be necessary in order to carry the terms of the requisition completely into effect, and the expenses incurred in and about so doing shall be recoverable by the Crown from the person guilty of the default by action in any court of competent jurisdiction.

6. (1.) If any inspector shall discover any diseased bird in any market or other place not being the premises in occupation of the owner of the bird, and whether such bird shall be under the control of any person or not, he may cause the bird to be destroyed or may impound or confine such bird in any place until it shall be completely freed from stickfast fleas: Provided that if such bird has been impounded and it shall appear to the inspector to be impracticable to free it from such fleas, he may cause the bird to be destroyed.

(2.) Any expenses incurred by an inspector in carrying out the provisions of this Regulation shall be a debt due from the owner of the bird to the Crown, and be recoverable by action in any court of summary jurisdiction.

7. (1.) If any inspector shall discover in any railway carriage, truck, or wagon, or on any railway premises, or in any market, or in any other place whatsoever, any crate or other receptacle containing diseased birds, or which has been or is reasonably supposed by the inspector to have been recently used for the carriage of diseased birds or is infested with stickfast fleas, the inspector may cause such crate or receptacle to be disinfected in such manner as he shall deem fit, and shall have authority to do or cause to be done all such things as he may deem necessary for that purpose.

(2.) The expenses incurred by any inspector in carrying this Regulation into effect shall be recoverable by the Crown from the owner of the crate or receptacle by action in any court of competent jurisdiction.

8. When any bird is treated by an inspector under these Regulations he may charge a fee of sixpence for such treatment.

When any bird is treated pursuant to any direction of an inspector, the inspector may supervise such treatment and charge therefor a fee of threepence.

9. Any breach of these Regulations shall be an offence punishable on summary conviction by a fine not less than five pounds and not exceeding one hundred pounds.

10. These Regulations may be cited as the *Stock Diseases* (*Stickfast Flea*) *Regulations*, 1924.

L. E. SHAPCOTT,
Clerk of the Executive Council.

Bulletins dealing with the life cycle of the Stickfast Flea and approved methods of control, together with any information available on this subject, may be obtained on application to the Department of Agriculture, Perth.

Special attention is directed to the new Regulations as it is intended to enforce them at once.

THE AUSTRALIAN FRUIT TRADE.

The National Federation Report.

The report of the National Federation of Fruit and Potato Trades' Associations, commencing on the fruit forwarded from Australia to London, is of sufficient interest to orchardists in Western Australia to warrant inclusion in the "Journal" and is reproduced hereunder.

In the remarks regarding methods of "packing" fruit-growers are advised that the American system ought to be adopted in Australia. This may be really good advice, so far as some quarters in the Eastern States are concerned, but it has little practicability in this State. In Western Australia the diagonal pack, which is the same as the American pack, is universally practised, and, so far as the Department of Agriculture is aware, the same applies generally to the Eastern States. However, inquiries are being made as to what is meant, and any information obtained will be published in a later issue of the "Journal."

MEMORANDUM CONCERNING THE AUSTRALASIAN FRUIT TRADE.

With a view to the improvement of the Australasian Fruit Trade, the National Federation of Wholesale Fruit Traders appointed a Committee to prepare a memorandum thereon for discussion by those engaged in the trade in Great Britain, and the memorandum as settled is now issued with the hope that it may be useful to growers, shippers, inspectors, and other Government officials concerned.

Whilst the efforts of various Governments have been directed towards securing a good name for the produce of their respective countries, it does not appear that sufficient consideration has been given to the difficulties which some of their regulations cause on this side of the world; it would seem that legislation has been endeavouring to obtain idealistic conditions irrespective of cost, instead of a realistic condition which embodies ideals coupled with commercial requirements. It may at once be stated that any suggestions herein contained are not meant to imply a desire to upset statutes, or regulations made under same; rather are they intended to show where some of the requirements are not at all helpful when the fruit arrives at British ports, but involve much time, trouble, and expense without corresponding advantage to the country of origin or to the actual producers, and retard quick distribution. Absolute perfection may be unattainable; improvements can be made which may result in better returns to fruit-growers, and the minimisation of increasing charges.

Costs of production have been materially added to by increased wages all round for cultivation, picking and packing at the orchards, and for procuring timber, the cost of nails and cases, higher cost of wrapping paper, and for the manning of ships and the provision of more accommodation and comfort of crews, which finds expression in the higher inland and ocean freights that have to be paid. On this side, handling and transport charges, influenced in exactly the same way, have increased enormously, and the tendency is fast

approaching a still higher standard. Whilst these increases should be counterbalanced by greater purchasing power, it must never be forgotten that Great Britain offers a market to the whole of the world on equal terms, once goods arrive here, and that, whilst higher charges may be made on some fruit importations, producers in many foreign countries enjoy greater facilities, and have much less to pay for freight, while their wages generally are also on a considerably lower scale.

Selection.—Care in selection is of primary importance. Fruit from young vigorously-growing trees, if sent at all, should not be mixed with fruit grown on well-matured trees; the former is soft and spongy, breaks down from its own vigour and bulk, and suffers much from handling, as it bruises more easily, and, once the skin becomes broken, speedily rots. Many packages when opened, if showing one, two, or three rotten fruits are at once regarded with suspicion; although 95 per cent. or more may appear good and sound, the price obtainable will be at least one shilling less, while on a heavily supplied market the difference may be several shillings. The use of pure sulphite wrapping paper to a large extent prevents one rotten apple from messing another, but whilst it confers advantage in this respect, if one or more be rotten, sound fruit in the same case is always suspect. A blemish which is no larger than a pin-head when the fruit is packed may develop quickly, until the temperature of a steamer's hold is "collared," and the fruit, although classed and packed to one grade, may lose its grade in consequence. It is, therefore, strongly recommended that specially strict compliance with regulations concerning grades be observed.

Packing.—The present system of packing apples is unsatisfactory, and we strongly recommend that the American system, as now followed by the New Zealand growers, be universally adopted in Australasia.

In packing the present cases, whilst they should always be well filled (especially as fruit is retailed here by weight and not by the piece), care should be taken that there be no undue pressure on any of the contents. Often, when cases are opened, bad apples are found in the corners, possibly because of hurry, or failure of the packer to hold the fruit together as packing proceeds, so that the fruit becomes irregularly placed. Even in cases that have been rather slackly packed corner apples have suffered, apparently because they were originally somewhat unnecessarily forced into their places.

Cases.—Cases should be strong, neat and clean in appearance. Tasmanian cases require less recoopering than any others, and are difficult enough to open, so that banding or wiring is entirely unnecessary. The timber of which they are made is of fairly straight grain, is not brittle, and the nails hold well, but many are stained by the sap having run and discoloured the wood, probably through lack of protection from weather whilst the timber is seasoning. Victorian cases are comparatively rough in appearance, the ends often split badly, the lids and side palings curl, rendering the piling (here) uneven and unsightly; space is an item of great importance in warehouses in this country as rents are very high, and, when cases pile unevenly, the space of a whole tier is easily lost. South Australian hard wood cases were this year very frail indeed, breakages at the ports of discharge were frequent and numerous; also, many of those made of pine and encompassed by a strand of wire became misshapen and broken, the wood not being of sufficient

strength. West Australian cases are fairly good, but the palings splinter badly through so many being cut across the grain; while the nails used do not seem to be long enough to make the package sufficiently strong. New Zealand cases are very good, well made and neat, but being of soft wood they would not stand the handling without the wires.

Complaint was made to the National Federation this year by the Australasian Shipping Conference that cases from all the States were frail, and it was pointed out that, under the terms of the bill of lading, recoopering was a liability that had to be borne by the consignee, and suggestion was made that consignors should be instructed to wire their cases. A suitable reply was sent, pointing out the incorrectness of the statement that "cases from all the States were frail," and attributing the breakage specially complained of to the stevedores. It is, however, recommended that greater care should be exercised in selecting timber for cases, especially from South and West Australia.

Branding.—There is room for much improvement in branding. On many of the hard-wood cases it is more or less indistinct, especially when the ends have been roughly manufactured. Where labels are used they are in some instances quite attractive, but the marking of grade and variety should be in larger letters on New Zealand cases, and placed where they can be more readily seen. It is understood that "The Commerce Act" of Australia imposes branding with which growers must comply, but much of it is really unnecessary and confusing on this side; it must also be the cause of waste in time, trouble, and expense to the packer. It is all-sufficient to have the grower's name or initials (or design), the consignee's number, initials denoting variety, and figures showing size of fruit, placed on *both ends* of cases alike. The marking of a case with the words "One bushel Sound Apples" becomes a ridiculous absurdity on an ullaged case, especially on cases in which unsound fruit appears on arrival. Some cases have the case-maker's name and address branded on them in addition to that of the grower and the shipper. The main considerations should be simplification and legibility; so many of those whose duty it is to handle the fruit on this side are not ready readers; they become confused with so many brands, valuable time is, therefore, wasted in sorting and piling.

The American system of indicating grade is by coloured label, blue for "Extra Fancy," red for "Fancy," and white for "Choice" (or 1st, 2nd, and 3rd grades). This system might be considered with advantage by Australasian packers.

Varieties.—Although there are in a country such as this buyers for almost everything, it is not advised that the poorer varieties be shipped; in any event, it is urgently desired that small parcels under one brand should, if at all possible, be limited to one variety. It would perhaps be better for a grower to miss a steamer with a variety, if he cannot make up at least ten cases of same; if only three or five cases of one variety be ready at the time when one steamer is to sail, he may be able to make up ten by holding them back for the next. The buyer of two or three cases at a time is not despised, but he knows that small lots are passed over by those who purchase long lines, so that he does not have to meet the competition of big buyers, and he feels more certain of getting these small lots at a lower price. To the broker or salesman small lots are troublesome and involve disproportionate expense;

in the first instance, in warehouse space for display, as they cannot be piled with other varieties but must be kept separate; next, in classing, lotting and cataloguing, small parcels containing several varieties occupy more time and involve difficulty in selling, as it takes just as long (often longer) to sell a few cases as fifty or one hundred; they also entail more book-keeping and accounting for. More trouble is caused to shippers, specifications are burdened with complexity, and as time is of so much importance when documents have to be prepared and completed, in order to get them here in advance of the ship carrying the fruit, anything that can be done to save clerical work should be a consideration. And when, in addition to a number of varieties in a parcel there are also a number of grades and sizes, it should be obvious that relatively these small parcels are uninteresting, unprofitable, and an obstacle in the way of charges-reduction.

Grades.—The question of grades is not one for easy decision; many differences of opinion find expression, but it may be taken as an axiom that three grades are quite sufficient. Probably growers would find it more advisable to have separate brands for different grades because, *e.g.*, "Special," "Standard," or "Plain" may each and all embrace various sizes, variety in colour, conditions of growth and season. Buyers are not concerned with the ideas of growers and packers in regard to grades, but they are with the actual grading; they do not buy on outside appearance, but lift the lids or sides, depreciate badly graded fruit (*i.e.*, mixed sizes, spotted fruit mixed with clean, badly shaped specimens upsides with those more truly formed), and then assess their valuation on the worst in the case. If, however, a grower puts his best of each grade ("Special," "Standard," or "Plain") under separate brands, all he need do is to take care that each is good of its grade, and thus obtain for each brand a name that will carry far. Buyers soon find out that "John Doe" packs good, sound, clean, evenly graded fruit, and gives good weight in his cases; those who want "Special" will compete for that grade, those whose needs are satisfied with "Standard," for that grade, those who have customers for "Plain," for that, but it will be for "John Doe," in preference to other brands that are not so well graded or packed. If when the grower gets his returns he finds his lower grades have made more than the higher, he may safely attribute the differences to the vagaries of the market; in other words, as sometimes happens, there are more buyers for one grade than another at that particular time.

Before leaving the subject of grading something may be said regarding sizes. Generally speaking dessert apples should not be larger than 2½in. in diameter. Culinary varieties need to be large, say 2½in. or 2¾in. in diameter; for some markets 3in. meet with favour for dumplings, or for baking whole; if under 2½in. there is too much of the apple lost in peeling and coring.

Regulation of Shipments.—It is considered very desirable to have the shipments better regulated. All concerned on this side fully recognise the enormous disadvantage of time and distance, also that vessels of varying speeds, and trading by different routes, cannot conform to an arrival schedule that would obviate all objections; differences in insulated-chamber capacity, and of methods of refrigeration, must also be allowed for, as no one line, nor even three lines could cope with the trade. It is, however, considered that something can be done towards improvement and the avoidance of

vexatious delays which may so easily result in clashing of arrivals. When at the close of a season a steamer has made a protracted voyage much of the fruit carried by such steamer may be more or less out of demand. Heavy supplies of English and Continental soft fruits are then occupying the markets, and the public turn attention to them, if only for the sake of change. The latter happened a few years ago, when one steamer was 90 days making the voyage, bringing varieties in the middle of the season which buyers always look for in the first fortnight or three weeks. This year the same steamer was again a delinquent, being the first to load and leave, the tenth to arrive; another came at the end of the season, and 91 days elapsed from first loading to final discharge. Such lengthy voyages, with perishable fruit in the holds, should not be tolerated; an undertaking should be given that, barring accidents, fruit-cargoes should not take longer than 60 days from first port of loading to final discharge port. Thirty days earlier arrival would have meant, in this particular instance, something like £10,000 to £12,000 more for the fruit-cargo carried, as by the time the fruit was delivered for sale the markets were full of other fruits; it is safe to assume that less waste would have been found amongst the apples and pears, and sales would have taken place when markets were still in need of supplies and the consumers had not so much choice of early summer fruits. Steamers voyaging to a time schedule may of course sometimes be a few days behind due dates of arrival, but that is of minor consideration; other steamers, and especially those carrynig fruit from one port only, should be expected to come right away from that port with all possible speed. Another matter of importance is that holds containing fruit should not be opened at subsequent ports if more than three, or at most four, days have elapsed, as a dangerous rise of temperature is sure to occur, which is certain to affect the fruit already well on the way to being cooled down; and, unless the fruit taken in at the subsequent port has been pre-cooled before loading, the latent heat it contains must prevent the temperature of the fruit first loaded being "collared" as soon as it is necessary to prevent the development of "Bitter Pit," and cause undue ripening, tending to inevitable waste. It is also thought that vessels which land cargoes in bad condition should not be given fruit to carry in subsequent years.

Consignees' Numbers.—The use of consignees' registered numbers has facilitated discharge and delivery, except where one grower has divided his consignments between two consignees and used the same number for each. It is hoped that the system of a separate number for each consignee will be universally and rigidly adopted and applied.

Ocean Freights.—It is considered that the ocean freight is too high, and efforts to obtain a reduction before next season will again be made by the National Federation.

Much statistical information has been collected from time to time which shows unfair discrimination against the fruit industry. Further representation will also be made towards getting the shipping companies to accept payment of freight on this side. Fruit from almost every other part of the world comes to England on a "freight collect" basis.

VITICULTURAL NOTES.

Dried Fruits—Grapes.

H. K. Johns,
Viticulturist.

The importance of properly training a vine from its inception is equally as essential as the practice adopted in fruit trees, and the system adopted has a distinct and considerable bearing upon the quality of the fruit and quantity borne, so that those who contemplate planting will find the following hints useful.

ZANTE CURRANTS.

Planting.—9ft. apart, 11ft. between rows.

Trellis.—Posts erected between every third row of vines—two wires 2ft. 6in. and 3ft. 10in. from the ground. The following are a few of the several methods of training vines on wire:—

1. Vines placed alternately on top and bottom wires and arms run in each direction, thus giving each vine a spread of 9ft. in either direction.

2. Vines placed alternately on top and bottom wires but arm carried in one direction only, thus giving the vine an 18ft. spread in one direction.

3. Crown formed at each wire and arms run in each direction on both wires, giving the vine a 4ft. 6in. spread in each direction on both wires. This method is fast disappearing owing to the fact that as the vines grow older the fruit on the lower arms diminishes, thus reducing the yield.

Pruning.—Spur pruning along the permanent arms, Thomery Espalier system, is favoured on light to medium heavy soils. A good yield of high density and quality fruit will result; also, the cost of vineyard labour is considerably lightened, inasmuch as time is saved in pruning, pulling of prunings, and tying down rods. On rich heavy soils where vines show vigorous growth, spur and few rods to be left.

Cincturing.- The double cut is generally adopted on the trunk of the vine—a ring of bark about 1/16th of an inch in width is taken out right down to the Cambium layer. Special cincturing knives can be procured with double blades. The objection to the single cut is that it does not provide sufficient check to prevent the sap from rising, the cut heals over too quickly. Cincturing is carried out just at the time when the flowers on the bunch have started to die and fall or when the berries are the size of very small shot. The cincturing should be done as speedily as possible in order to check the flow of sap to the newly formed berry until such time as it sets firmly on the bunch.

Topping. -This work is carried out in due season. Indiscriminate topping is not advisable owing to forcing out as large a crop as possible in the immediate present without thinking of the future.

Picking and Drying.—Currants ripen before any other of the dried fruits. They are picked and spread on the drying racks. *No dipping is required.* Drying in normal weather takes from 8 to 10 days. The fruit is

"cured" when a handful of berries can be squeezed up (not very tightly) and will not remain stuck together in one bunch. About 450 dip tins of green fruit represent approximately one ton of dried fruit.

SULTANAS.

Planting.—9 feet apart, 12 feet between rows.

Trellis.—Posts erected between every third row of vines—three wires—one wire 2ft. from the ground, one wire 2ft. 9in. from ground, one wire 3ft. 10in. from ground. The top wire carries the foliage, the other two wires carry the fruit-bearing rods.

Pruning.—The crown is formed on the middle wire. Many prune the Sultana for alternate wood and fruit growth, leaving long canes for fruiting and cutting back short ones to supply strong canes for the following season's fruiting; it is found with the sultana it bears finer bunches above the third or fourth bud from the base of each year's growth. Instead of adopting the spur and rod pruning, two to five rods are left in their stead and irrigated vines will carry 10 or more canes. As many rods as possible are brought down to the bottom wire with a sharp turn given to the rods at or near their base and the cane rolled on the wire. This will force the base buds on the rod to throw shoots for next season's fruit-bearing wood as close to the crown as possible. Do not let the crown spread, but keep the main arms inside the length of two feet on either side of the main stem. Sultanas bear fruit on the rod that comes from the previous year's wood.

Cincturing of sultanas is not generally adopted.

Topping is not done, but the foliage is rolled on to the top wire in proper season.

Picking and Drying.—Fruit is picked into dip tins, *i.e.*, galvanised iron tins like half a kerosene tin cut lengthwise and perforated on the sides and bottom with holes about ½in. in diameter. The fruit is dipped in a solution of boiling water and caustic soda (see "Dipping Mixtures" for quantity), and is then placed on the rack to dry. Drying takes from ten to fourteen days in ordinary summer weather. Sultanas are not "sweated," but racks are kept open unless unsuitable or wet weather appears. Sultanas ripen after Currants and before Gordos.

MUSCAT GORDO BLANCO.

The vine is a low straggling grower, an abundant bearer. The wood is short and stocky. This is a leading raisin grape both here and abroad, and it is also a good shipping grape, as it carries well, looks well, and many admire its peculiar flavour. It is sometimes used for sweet wine, such as Muscat, but its flavour is rather too pronounced.

In the irrigation districts of Victoria and New South Wales the above vines are planted mostly 6ft. apart and 11ft. between rows, but in this State where irrigation is not practiced, the vines require more space and should be 8ft. apart in the rows. A one-wire trellis is generally adopted in the irrigation districts of the Eastern States. The crown is formed 18in. to 20in. from the ground and the main arms are extended on either side.

Pruning.—Spur prune to two eyes along the permanent arm.

Drying—as for Sultanas.

Ripeness.—The taste is commonly the most used method for ascertaining the ripeness of raisin grapes. Every grower, experienced or not, should examine his grapes from time to time. To give directions for tasting ripeness of the grapes is impossible. It must be learned and can only be learned by practice; it is enough to say that the grapes should taste very sweet and contain no acid, and, if possible, be rather solid. A correct method is the use of a saccharometer (Keen's Hunter River Saccharometer); pick a few bunches from several vines; the juice is squeezed out and strained through a cloth or otherwise strained. The must is then poured into a glass test tube and the saccharometer inserted. Should it read 26.5deg. or upwards of sugar content, the grapes will make good raisins, but for extra special raisins several degrees more sugar are required, which can be obtained when soil and climate conditions are suitable. Some growers judge by colour, but grapes exposed to the sun acquire the yellow amber tint without being sweet, though they are readily distinguished from the ripe grapes by being smaller in size and harder, tasteless and acid, and never develop into good mature grapes. It is not all ripe grapes that become amber-coloured. Grapes grown in the shade and also on the inner portion of the vine sometimes remain green, but contain a certain sweetness and will make good raisins. Experienced growers keep their grapes on the vines as long as possible to obtain a high percentage of sugar.

DIPPING FRUIT.

A dip is made of a galvanised iron square tank holding about 30 gallons of water, with two flues running through the bottom of the tank. The tank is bricked in like a copper and has a drainage tap on the bottom in one corner. Water in the dip is always kept on the boil.

The Mixture.—For Sultanas and Gordos (Lexias) start with 1lb. caustic soda to 20 gallons of water and strengthen or weaken until the fruit when dipped for five seconds will show cracked skin on a few berries—one bunch can be used for the trial.

Dipping.—Place the tin of grapes into the mixture and keep immersed for about five seconds—not longer—then the tins should be left and place on a stand to drain. After draining for a couple of minutes the fruit can be spread on the drying racks. Not more than one bunch thick. Keep testing the strength of the mixture and keep it to the required strength

DRYING RACKS.

These are usually made in 50 yard lengths in order that the 100 yard coils of wire netting can be utilised without having wire netting joins in the body of the rack. The racks should be at least six yards apart in order to permit of easy working on each side of the rack when fruit is being taken off after having been "cured."

Dimensions of a good Rack:

Length—50 yards.
Height—8 feet.
Width—4 feet.
Distance between panels—10 feet.

Number of tiers of netting, 7 (10 inches apart—first tier 1ft. from ground).

Wire netting 4ft. wide—2in. mesh, 18 gauge.

Posts (end) 11ft. x 6in. small end.

Posts (intermediate) 10ft. x 4in. small end.

The most convenient rack is constructed so that the netting rests on crosspieces between the posts. These crosspieces are not firmly fixed to the post but rest on dog nails; each tier of netting can then be raised or lowered and so provide more working space when spreading fruit. A plain wire is laced through the netting on either side and these wires fit into a slot let into the crosspiece that carries the netting.

Vineyard Notes for December.—All the ordinary work should be completed by the end of this month, unless exceptional operations such as cultivation after rain and sulphuring if odium appears.

Vine Growing Notes for January and February.—Given suitable weather conditions odium may appear. Sulphur, but avoid applying sulphur to wine grapes too short a time before gathering.

Cellar.—Preparations for vintage should be gone on with; overhaul casks and plant. All utensils to be carefully cleansed—1oz. bisulphate of potash or a couple of fluid ozs. of bisulphite of soda solution to each bucket of water to tubs, presses, etc., will help to sweeten same.

Racking of all old wines should be completed so as to avoid handling during vintage.

HORTICULTURAL NOTES.

Geo. W. Wickens,
Officer in Charge of Fruit Industry.

SEASONABLE WORK FOR JANUARY, FEBRUARY, AND MARCH.

January.

Gathering and marketing will be the principal occupation during this month in orchards planted with stone fruit trees apricots, peaches, plums, etc.—and judgment must be used in picking to see that while the fruit has matured sufficiently to attain sweetness, it has not become ripe enough to run the risk of serious injury through bruising during transport. This refers particularly to fruit which has to travel long distances to market by rail. Those growers who are near enough to the metropolitan area to cart their produce by road in open cases can allow soft fruit to mature longer on the trees, and the writer has seen apricots and peaches offered for sale in single layer trays at the kerbstone markets which, although allowed to ripen before gathering, were in perfect condition.

Cultivators must be kept moving throughout this month to conserve moisture in the soil.

In all orchards in that portion of the State where fruit-fly exists, constant watchfulness and care are needed to combat the pest. All fallen fruit should be picked up daily, all infested fruit destroyed by boiling, and baiting carried out at ten day intervals. Turning infested fruits under the soil with cultivating implements is disastrous, for it is merely placing the pupæ in ideal conditions for carrying on the life cycle of the fly.

In the apple orchards summer heat will probably keep woolly aphis under control, but if not, spraying with black leaf 40 and soap must be resorted to.

Citrus orchards throughout the State were remarkably free from red scale last season, and the tiny internal parasite "Scutellista cyanea" was found to be widely spread and working effectively. Where the parasite is not present in infested orchards, spraying or fumigation should be carried out this month.

Red Mite did considerable damage in deciduous orchards last season, and where it appears should be treated with atomic sulphur spray, using 1 lb. atomic sulphur in ten gallons of water.

Where it is desired to work over stone fruit trees, budding may be carried out during this month.

February.

Gathering and marketing of stone fruits will still be in full swing during this month and early varieties of pears and apples will also claim attention. The very early pears, such at Citron des Carmes and Jargonelle, are allowed to ripen on the trees and are fit to gather in December and January, but these are poor in quality and are not recommended for commercial orchards. Practically all the best pears must be gathered before ripening and allowed

to mellow in storage before they attain the peak condition of flavour and texture. In a less degree this applies also to apples, but there are some good varieties of the latter fruit which are excellent for dessert purposes when freshly pulled from the trees; Gravenstein and Jonathan being two good examples.

The ease with which the stem of the fruit separates from the spur to which it is attached is a good guide as to the fitness of the fruit for gathering.

This month usually sees the first shipment of apples to England, but it is hoped that growers will refrain from exporting immature fruit this season and put off export until about the end of the first week in March. This applies particularly to Jonathans, which should not be gathered until they have attained a good rich red colour. The early ripening specimens generally are borne on terminal buds; they are soft and spongy, lacking in colour and quality, and very apt to develop bitter pit, and Jonathan spot, on the voyage. They often up so badly on arrival in England that they spoil the sale of later consignments of the same variety, which, when of 2¼in. to 2½in. in size and gathered at the right time, is one of the best export apples grown. If an early picking must be effected then Cleopatra is much safer to gather on the green side than Jonathan, but, as stated, the advice is to entirely refrain from exporting immature apples.

Cultural operations and pest control are practically the same this month as last.

March.

This is the busiest harvesting month in the year for most of the fruit-growers in the State—especially those, and there are many, who have not specialised in one or two kinds of fruits but have planted out mixed orchards containing many kinds and varieties. Peaches, nectarines, and late ripening plums, require marketing; apples and pears must be gathered for export, local markets and cold storage; the grape growers will be busy picking and packing for export, local markets, and attending to drying currants, sultanas, and raisins.

This is being written in November before the time when a reliable estimate of the season's crop can be made, but the prospects are that there will be a bumper crop of practically all kinds and varieties of fruits, and if this is realised the advice to pack and grade carefully all fruit sent either to local markets or exported overseas cannot be too strongly emphasised. Rubbish, such as poorly grown, woody, malformed, or diseased specimens cannot be sold at a price that will pay freight and commission on a heavily supplied market, and the presence of such fruit always brings down the price of good fruit. Great attention must be paid to packing and grading, and the grower with good fruit, packed and graded evenly and well—not mixed sizes and qualities all jumbled together in one case—will make a name in the markets that will sell his fruit in spite of plentiful supplies.

This is the month of the year above all others when the fruit fly is most in evidence, needs most attention, and, because of pressure of other work, is most neglected; but there is no work in the orchard which is so absolutely essential as the control of this pest, for if it gets beyond control the results of all other work are negatived.

GARDEN NOTES.

JANUARY.

Sow: *Beans.*—Canadian Wonder, Pale Dun (Dwarf), Kentucky Wonder, Epicure (Runner), Lima, Henderson's Bush.

Peas.—Only where land is very moist, Yorkshire Hero and William Hurst.

Carrots, Parsnips, Beetroot, Raddish, Lettuce, Parsley, Herbs, Cucumbers, Vegetable Marrow, Custard Marrow, Cauliflower, Cabbage.

Onions.—(Small sowing only), Silver Skin, or White Barletta.

Transplant.—Early Cauliflowers and Cabbage, late Tomatoes and Celery.

FEBRUARY.

Same as January.

MARCH.

This month the winter garden seeds for transplanting must be sown. The plants will then be ready for moving about May.

Sow.—Parsnips, Beet, Turnips, Carrots, Cauliflowers, Cabbage, Broccoli, Raddish, Peas, Broad Beans, Sea Kale, Mustard Cress, Rhubarb.

Transplant.—Cauliflowers, Cabbage, Broccoli, Celery.

METEOROLOGICAL INFORMATION.

As a feature that will be helpful to the Man on the Land it has been decided to include in every issue of the "Journal" meteorological information as close up to the time of issue as is available.

This information will cover temperature and rainfall statistics from fourteen stations throughout the Wheat Belt and the South-West of the State. In course of time the information thus given will have a high value for reference and will enable farmers and others to make comparisons between the meteorological phenomena of the current season and those for past years.

1924.

STATIONS.	TEMPERATURE.				RAINFALL.		TEMPERATURE.				RAINFALL.		TEMPERATURE.				RAINFALL.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	MAY.						JUNE.						JULY.					
					inches.	inches.					inches.	inches.					inches.	inches.
Chapman State Farm	74·3	87·4	50·8	40·8	1·75	2·27	67·9	79·0	47·9	40·0	4·16	3·92	67·3	78·8	44·7	37·2	3·73	3·94
Geraldton	75·4	87·4	57·2	48·3	1·67	2·84	70·4	80·0	53·4	43·2	3·65	4·74	70·2	77·3	51·4	43·7	2·31	3·94
Walebing	71·3	85·8	46·2	35·5	2·83	2·48	64·0	75·2	44·9	35·5	3·49	3·97	64·1	72·8	41·4	32·8	2·85	3·60
Perth	70·1	84·5	53·0	42·9	4·98	4·94	65·5	74·0	49·1	42·2	5·11	6·93	65·5	74·3	49·4	40·0	3·79	6·50
Kalamunda	66·6	80·4	51·9	41·8	5·96	5·90	62·2	71·3	48·0	42·4	5·63	8·22	61·6	70·4	48·4	38·6	4·84	7·91
Bunbury	68·7	80·0	51·4	41·0	6·68	5·31	65·3	74·2	47·6	39·2	5·87	7·24	64·2	70·4	49·2	38·4	5·95	6·93
Bridgetown	66·4	84·0	43·6	33·0	6·30	4·53	61·7	70·0	39·2	32·0	4·28	5·95	61·4	70·0	41·4	32·0	5·52	5·73
Albany	69·6	80·0	51·3	43·8	6·78	5·04	64·4	71·4	49·2	38·4	3·73	5·57	63·9	72·0	48·0	40·0	3·84	5·50
Merredin State Farm	68·3	84·6	44·8	35·0	1·77	1·31	61·5	71·9	41·5	33·2	2·00	1·84	62·5	72·1	39·5	31·9	0·94	2·06
Northam	69·2	84·0	48·7	39·2	2·29	2·23	61·3	70·2	47·5	35·8	2·23	3·32	61·2	67·8	40·0	29·8	2·14	3·37
York	70·4	85·5	46·3	35·0	2·38	2·35	64·1	74·0	41·6	33·8	2·23	3·39	64·3	72·2	39·5	29·0	2·08	3·29
Narrogin State Farm	66·2	81·5	46·3	34·0	4·38	2·78	59·8	70·0	42·1	35·5	2·83	3·77	59·8	67·9	42·7	32·4	2·76	4·07
Katanning	65·6	82·2	46·5	34·0	4·58	2·28	59·4	69·5	43·2	36·0	2·14	2·90	59·0	65·5	42·0	32·5	1·55	3·01
Cape Leeuwin ...	66·6	75·5	56·9	47·0	8·26	5·58	63·3	70·0	54·0	45·0	7·70	6·88	62·8	68·2	53·8	45·0	8·81	7·06
	AUGUST.						SEPTEMBER.						OCTOBER.					
Chapman State Farm	66·6	78·8	43·5	38·2	2·96	2·81	70·6	89·3	47·9	40·5	1·58	1·62	71·3	89·2	48·0	40·0	2·08	0·92
Geraldton	68·3	80·0	50·5	43·2	2·48	2·99	71·6	78·8	54·9	42·0	1·02	1·38	70·9	86·4	55·3	45·8	2·14	0·68
Walebing	63·2	77·8	40·2	31·5	3·70	3·11	67·9	79·5	45·6	39·0	1·50	2·19	69·3	85·2	45·2	37·0	2·90	1·29
Perth	62·7	76·6	46·1	38·1	8·44	5·64	66·9	81·0	50·2	42·0	2·23	3·43	65·9	78·5	50·9	40·5	5·50	2·11
Kalamunda	59·4	71·0	45·3	38·0	9·55	6·81	64·4	80·0	48·5	40·7	2·68	4·77	64·2	79·7	48·2	38·7	6·70	3·09
Bunbury	62·2	69·5	45·5	35·2	5·61	5·52	66·8	72·8	48·3	36·4	3·38	3·71	65·7	71·5	50·0	37·2	4·41	2·41
Bridgetown	58·8	70·5	38·0	30·0	6·34	5·22	64·7	77·0	43·9	31·0	3·16	3·87	63·8	77·5	43·5	34·0	5·86	2·92
Albany	62·0	70·0	45·7	39·0	5·91	5·25	61·8	67·8	48·5	39·4	5·82	4·00	64·0	74·0	48·0	41·0	6·97	...
Merredin State Farm	61·6	74·5	37·9	29·1	1·79	1·56	67·5	85·0	43·0	33·9	0·89	0·96	69·9	84·0	45·4	30·0	1·54	0·83
Northam	61·4	69·0	39·2	33·0	2·91	2·64	66·5	81·2	44·7	35·0	1·09	1·66	69·4	84·4	47·4	35·0	2·02	0·98
York	61·9	73·0	39·1	31·2	3·10	2·91	68·8	84·2	44·6	35·0	0·94	1·65	70·0	83·0	46·1	33·0	1·66	1·03
Narrogin State Farm	58·0	67·2	38·1	29·8	5·25	3·25	62·9	74·8	42·8	33·5	1·35	2·41	64·3	77·4	43·9	33·0	2·65	1·37
Katanning	57·1	66·3	39·6	31·0	3·06	2·54	62·6	77·0	43·7	32·8	1·51	1·97	63·5	74·5	44·3	35·3	2·98	1·50
Cape Leeuwin ...	60·3	68·2	51·9	47·0	6·60	5·30	62·8	68·0	53·4	48·0	4·47	3·11	62·2	67·0	53·6	48·0	4·54	2·79

PRODUCE PRICES.

Market Report.

The following particulars of the approximate quantity of chaff available for auction at the Metropolitan Chaff and Grain Auction Sales held in Perth during the months of September, October, and November, 1924, also the minimum and maximum prices ruling for f.a.q. to prime quality during those months have been supplied by Messrs. H. J. Wigmore & Co., Ltd., of Wellington Street, Perth, and will be valuable for reference:—

Wheaten Chaff—

September: Quantity—2,900 tons.
Minimum price—£6 2s. 6d. per ton.
Maximum price—£7 17s. 6d. per ton.

October: Quantity—1,700 tons.
Minimum price—£6 12s. 6d. per ton.
Maximum price—£8 2s. 6d. per ton.

November: Quantity—2,500 tons.
Minimum price—£5 12s. 6d. per ton.
Maximum price—£8 2s. 6d. per ton.

The first truck of new season's chaff arrived in Perth on the 15th October, but the rains experienced about that time interfered with chaff-cutting operations, with the result that only an occasional truck found its way to market, and with no cutters working old season's supplies were scarce, resulting in the very nice price of £8 2s. 6d. per ton being secured at the end of October and beginning of November. However, as the weather cleared up chaff-cutting commenced in earnest, and with a plentiful supply prices gradually receded, and at time of going to press the market is steady at around £5 12s. 6d. per ton. We think it is probable that lower prices would have been ruling, but immediately prices came below the £6 mark a number of farmers ceased consigning, prefering to store and take the risk of better prices later. It is a very hard matter to even make a guess as to the future prospects of the market, as so much depends on the opening of the coming season.

Oaten Chaff.—Up to the time of writing supplies have been rather scarce, practically no consignments arriving from the Great Southern. A few trucks of prime quality have been finding their way to market from the Kellerberrin district, and these have realised prices equal to those ruling for f.a.q. to prime wheaten.

Oats.—Supplies coming to hand are about equal to the demand, and the market for good heavy feeds is steady at from 3s. 3d. to 3s. 4d. per bushel.

Wheat.—There is a good inquiry, and supplies available for auction are light, and the value of f.a.q. on this market is from 6s. 5d. to 6s. 6d. per bushel.

LIVE STOCK AND MEAT.

For the information of readers of the "Journal," the following particulars have been supplied by Messrs. Elder, Smith, & Co., Limited, Perth:—

COMPARATIVE YARDINGS OF STOCK AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1924.

	September.				October.					November.			
	3.	10.	17.	24.	1.	8.	15.	22.	29.	5.	12.	19.	26.
Sheep and Lambs	9,900	12,784	9,823	14,558	12,664	8,689	16,955	16,885	15,205	14,111	13,232	23,034	12,286
Cattle ...	1,195	600	468	400	620	672	621	568	562	534	456	563	685
Pigs ...	512	746	621	654	987	506	617	801	682	745	772	439	594

COMPARATIVE VALUES OF STOCK SOLD AT METROPOLITAN FAT STOCK MARKETS, DURING MONTHS OF SEPTEMBER, OCTOBER AND NOVEMBER, 1924.

	September.				October.					November.			
	3.	10.	17.	24.	1.	8.	15.	22.	29.	5.	12.	19.	26.
Mutton	12	12	12½	13	*13 †10	*13½ †10½	*14 †11	*13¾ †10½	† 10¾	† 10¾	†10½	† 10½	† 11
Beef ...	8½	8½	9½	9½	8½	7¾	7½	7½	7½	7½	7½	7½	7½
Pork ...	11	11½	11½	11½	10½	10¾	11	10½	11	10½	9	11½	11½
Bacon ...	10½	10¾	10¾	10½	10½	10½	10½	10½	10½	10	9½	9¾	10

* wool. † shorn.

WESTERN AUSTRALIA—DEPARTMENT OF AGRICULTURE.

List of Bulletins available for Distribution.

No. 20.—"The Pruning of Fruit Trees." By J. F. Moody. Price 2s. 6d.
No. 46.—"Fruit Packing and Marketing and Exporting of Fruit." By J. F. Moody and J. Ramage. Price 1s. 6d.
No. 47.—"The Poultry Keeper's Manual." By G. Allman. Price 1s.
No. 83.—"Horticulture and Viticulture." By A. Despeissis. Price 2s.
No. 5.—"Fruit Drying." By J. F. Moody. Free.
No. 15.—"Root Rot." By A. J. Despeissis. Free.
No. 24.—"Hints to Stock Breeders" (revised). By R. E. Weir. Free.
No. 41.—"Irrigation and Drainage." By A. H. Scott. Free.
No. 49.—"The Feeding of Horses." By Professor Paterson and G. L. Sutton. Free.
No. 57.—"Vermin Destruction." By A. Crawford. Free.
No. 60.—"The Farmer's Clip." By J. J. Mahood. Free.
No. 68.—"Flaying and Treatment of Hides." By R. E. Weir. Free.
No. 72.—"The Potato: Its Cultivation, Pests and Diseases." By G. N. Lowe, L. J. Newman, D. A. Herbert. Free.
No. 74.—"Tobacco Growing: Notes for Intending Planters." By G. W. Wickens. Free.
No. 79.—"Sheep on the Wheat Farm and their Management in W.A." By H. McCallum. Free.
No. 81.—"The Improvement of Pastures." By E. A. Mann and D. A. Herbert. Free.
No. 87.—"Sheep Feeding Experiments: State Farm, Chapman, 1920." By G. L. Sutton and F. Vanzetti. Free.
No. 88.—"Light Land: Conference." By G. L. Sutton. Free.
No. 90.—"Stock Waters: Standard for Composition of." By E. A. Mann. Free.
No. 93.—"The Home Tanning of Sheep and other Skins." By H. Salt. Free.
No. 94.—"The Dingo." By B. W. Leake. Free.
No. 95.—"The Stickfast Flea." By L. J. Newman and Geo. Allman. Free.
No. 96.—"Poison Plants of W.A." By D. A. Herbert. Free.
No. 99.—"Australian White." By G. L. Sutton. Free.
No. 101.—"Cotton Cultivation." By G. L. Sutton. Free.
No. 103.—"Kerosene Method for Eradicating Zamia Palm." By G. K. Baron-Hay. Free.
No. 104.—"Stickfast Flea." By J. G. C. Campbell. Free.
No. 105.—"Pedigree Selection of Seed." By G. L. Sutton. Free.
No. 106.—"The Red Legged Velvet Earth Mite." By L. J. Newman. Free.
No. 107.—"Sudan Grass." By G. L. Sutton. Free.
No. 108.—"Lucerne." By G. L. Sutton. Free.
No. 109.—"Rape." By G. L. Sutton. Free.
No. 110.—"Subterranean Clover." By G. K. Baron-Hay. Free.
No. 111.—"Standard Wheat Varieties." By G. L. Sutton and F. Vanzetti. Free.
No. 112.—"Automatic Device for Eradication of Stickfast Flea." By G. Allman. Free.
No. 113.—"Picked Pieces (Classification of Clip)." Free.
No. 114.—"Blue Mould on Citrus Fruits." By W. M. Carne. Free.
No. 115.—"The Value of Windmills for pumping water in W.A." A. H. Scott.
No. 116.—"Spotted Wilt of Tomatoes." W. M. Carne.
No. 117.—"Cream." P. G. Hampshire.
No. 118.—"Pigs and Pig Raising." P. G. Hampshire.
No. 119.—"Take-all of Wheat and Similar Diseases of Cereals." By W. M. Carne and J. G. C. Campbell.
No. 120.—"Pastures in the South-West." A. B. Adams. (Reprint from "Journal.")
No. 121.—"Mildew, Septoria, Leaf Spots, and Similar Diseases of Cereals." W. M. Carne and J. G. C. Campbell.
No. 122.—"Fruit-fly. Description and Control." L. J. Newman.
No. 123.—"The Development of a Dairy Herd." P. G. Hampshire. (Reprint from "Journal.")
No. 124.—"Government Inspection of Wheat." G. K. Baron-Hay. (Reprint from "Journal.")
No. 125.—"Buy Good Seed." (Advice to Farmers.) W. M. Carne. (Reprint from "Journal.")
No. 126.—"The Rust of Cereals." W. M. Carne and J. G. C. Campbell.

No. 127.—Wheat Yields—Competitions.
No. 128.—"Woolly Aphis Parasite (*Aphelinus mali*)." (Hald.) L. J. Newman. (Reprint from "Journal.")
No. 129.—"The Farm Horse: Hints on Feeding." A. McK. Clark. (Reprint from "Journal.")
No. 130.—"Minerals and the Health of Cattle." A. B. Adams. (Reprint from "Journal.")
No. 131.—"The Strength of Wheat and Flour." R. G. Lapsley. (Reprint from "Journal.")
No. 132.—"Development of a Dairy Herd—No. 2." P. G. Hampshire. (Reprint from "Journal.")
No. 133.—"Kikuyu Grass for Poultry." G. L. Sutton. (Reprint from "Journal.")
No. 134.—"Flag Smut of Wheat." W. M. Carne. (Reprint from "Journal.")
No. 135.—"The Objects of Farmers' Trials." G. L. Sutton. (Reprint from "Journal.")
No. 136.—"The Use of the Scythe." H. Campbell. (Reprint from "Journal.")
No. 137.—"Winter Trapping of the Fruit-fly." L. J. Newman. (Reprint from "Journal.")
No. 138.—"Clearing Heavily-timbered Pastures." A. B. Adams. (Reprint from "Journal."
No. 139.—"Ants as a Domestic Pest." J. Clark. (Reprint from "Journal.")
No. 140.—"Surface Drainage." A. R. Clifton. (Reprint from "Journal.")
No. 141.—"Breeding a Permanent Flock." H. McCallum. (Reprint from "Journal.")
No. 142.—"The Plague Locust." L. J. Newman. (Reprint from "Journal.")
No. 143.—"Zamia Palm and 'Rickets' in Cattle—Method of Eradication." A. B. Adams and G. K. Baron-Hay.

The following publications may be obtained from the Department of Agriculture, Perth, on application, or will be sent post free to any address in this State on receipt of a remittance for the amounts stated:—

"The Handbook of Horticulture and Viticulture of Western Australia," by A. Despeissis, M.R.A.C.:

This publication contains valuable information dealing with all commercial fruits grown in Western Australia, including advice on planting, pruning, packing, manuring, fruit-drying, wine-making, insect and fungoid pests and their treatment, etc., and the whole forms a text book which every fruitgrower, whether large or small, should have in his possession. The price originally was 8s. 6d., but to allow of distribution being as wide as possible, it has been reduced to 2s.

"The Pruning of Fruit Trees," by J. F. Moody, Fruit Industries Commissioner:

This publication contains numerous illustrations, being reproduction of photographs taken in this State, of pruned and unpruned trees, which make the details set out in the letterpress particularly easy to understand. Price, 2s. 6d.

"Fruit Packing and the Marketing and Exporting of Fruit," by J. F. Moody, Fruit Industries Commissioner, and J. Ramage, Packing Instructor:

This publication contains invaluable information on packing and grading fruit for local and export markets. It is freely illustrated, and no fruit-packing shed should be without a copy. Price, 1s. 6d.

"The Poultry-keepers' Manual," by George Allman, Government Poultry Expert:

This is a most useful and valuable book, not only for beginners, but to all those who keep fowls for pleasure or profit. It deals fully with all matters connected with the industry, including Breeding, Feeding (for stock birds or egg production), Incubating, Brooding and care of chicks, Marketing (eggs and poultry), and all matters of use to the poultry-keeper. It also fully describes symptoms of various ailments and diseases and simple treatment for same, and, as the book was written to suit *Local Conditions*, every poultry-keeper should have a copy by him. Price, 1s.

By Authority: Fred. Wm. Simpson, Government Printer, Perth.

(Second Series) Vol 1.

Western  Australia.

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